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MNC-BORNE FDI, ABSORPTIVE CAPACITY AND ECONOMIC GROWTH: AN EMPIRICAL INVESTIGATION

by

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DECLARATION

I, Senia Nhamo declare that the research work reported in this dissertation is my own, except where otherwise indicated and acknowledged. It is submitted for the degree of Doctor of Philosophy in the University of the Witwatersrand, Johannesburg. This thesis has not, either in whole or in part, been submitted for a degree or diploma to any other universities.

Signature of candidate ……*S.Nhamo*…….. Date…03-06-2011....

ABSTRACT

The liberalization of FDI is deepening, so have the incentive schemes put in place by a number of countries. Investment promotion agencies in these countries are seen to be actively promoting their countries as the best locations for foreign direct investment (FDI). With FDI emerging as a fovourite source of capital for most countries, profound questions about the true value of FDI to host countries are addressed in this study. While incentive packages may be justified on the basis of incomplete internalization of FDI benefits by foreign firms, it still remains critical to establish whether these benefits (spillovers) are substantive. As an attempt to answer these questions, this dissertation uses both firm level and country level data to investigate the effects of foreign direct investment (FDI) on productivity and economic growth.

The first part of the study uses cross sectional firm level data to investigate whether foreign firms are more productive than domestic firms. We further examine whether there are any significant productivity spillovers from foreign to domestic firms or not. SIn the second part, focus is on country level analysis which uses both time series and panel data techniques. In the time series analysis we use the recent Toda-Yamamoto causality testing framework to determine the direction of causality between FDI and growth for three groups of countries: developing, emerging and developed countries. This is followed by fixed effects and dynamic panel data analyses for the 37 countries (9 developing, 12 emerging and 16 developed) where we test for absorptive capacity effects. Our findings show that results are determined to a great extent by the method of analysis.

Interesting findings emerge from this study. The firm level data revealed the importance of multinational corporations in improving domestic firm productivity. With this finding, we anticipate these results to filter through the macro system and show up in the time series and panel data analyses. In the case of developing economies, productivity differences between domestic and foreign firms are confirmed only where the definition of FDI is below the full ownership level. Positive but statistically insignificant spillovers are found in the developing country sample. From the emerging economy sample, we

find neither significant productivity differences nor related spillovers from foreign to domestic firms. With regards to developed economies, as in the case of emerging economies, there are no statistically significant productivity differences between domestic and foreign firms. Interestingly, for this sample, positive and highly significant spillovers from foreign to domestic firms are documented.

The Toda Yamamoto Granger causality framework shows unidirectional causality from FDI to GDP in Colombia, Egypt and Zambia. These results suggest that in these three countries, we have a case of growth enhancing FDI. There is also evidence of causality which runs from GDP to FDI in China, Indonesia, France, Japan, Spain and the United Kingdom. This is a case where higher levels of economic activity attract foreign direct investment. We also find evidence of bi-directional causality for Argentina, Kenya and Thailand. No clear cut relationship between FDI and growth is established in the rest of the countries: Brazil, Chile, Ghana, India, Jordan, Madagascar, Malawi, Morocco, South Africa and all but four of the developed economies.

The dynamic panel data analysis for the developing economy sample reveals positive effects between FDI and economic growth. A key finding from this is the negative impact of financial development, an absorptive capacity measure. This unexpected result raises the possibility of international capital flows becoming more harmful to developing economies when extensive development of the domestic financial sector makes it difficult to regulate financial transactions of relatively esoteric financial contracts. This evidence there should be a nuanced embrace of financial globalization by developing economies. In the emerging economy analysis, the roles of openness of the economy and financial development as absorptive capacity indicators are elevated.

Overall, the dynamic analysis shows a largely negative and statistically insignificant effect of FDI on economic growth. For developed economies, we find that negative effects of FDI on economic growth are encountered at both the minimum and mean levels of openness. This suggests that for developed economies, a level of openness above the mean value would be ideal for economic growth to be realized through FDI.

Corroborating our findings with the work of other scholars, we conclude that our results are complementary. It appears that the contradictions inherent in the FDI-Growth literature could be partly due to methodological differences.

DEDICATION

This thesis is dedicated to:

My parents: Sylvia and Hudson Chemhuru

My husband: Dr. Godwell Nhamo

My children: Anesu, T. and Tsitsi, M. Nhamo

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All errors and omissions are, of course mine.

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CHAPTER 1: INTRODUCTION AND BACKGROUND

1.1 BACKGROUND TO THE PROBLEM

Foreign Direct Investment (FDI)[1] is a key element in the development strategies of both developed and developing countries (IISD, 2005). Evidence of increasing levels of FDI inflows is reported in the 2008 United Nations Conference on Trade and Development's (UNCTAD) world investment report. The growth rates of FDI inflows in three major groups of economies show record levels of 84.6% for transition economies, 53.9% for developed economies and 30.5% for developing economies (UNCTAD, 2008). The large inflows of FDI are evidence that most countries have opened up for FDI.

In this study we identify an economic epoch characterised by increasing FDI inflows, fiscal and financial incentives for multinational corporations and the desire to increase productivity at the firm level and ultimately economic growth. As the flows of FDI are increasing the world over, competition to get the most FDI is rising. This is seen through the different incentive schemes that many countries have put in place, as well as the investment promotion agencies existing in most of the countries. Two types of incentive schemes are often adopted. The first one is what has been called the "beauty contest" approach (Oman, 2000). This is where governments concentrate on beautifying their countries through improving their institutions, human capital development through education and training as well as infrastructural development. The second approach is through fiscal and financial incentives such as tax holidays, duty drawbacks, and grants in aid, investment allowances and exemptions from environmental standards (Blomstrom & Kokko, 1998; UNCTAD, 2004). There are several instances where countries have given special incentives schemes to foreign companies to encourage them to invest in their economies.

[1] "Foreign Direct Investment reflects the objective of obtaining a lasting interest by a resident entity in one economy ("direct investor") in an entity resident in an economy other than that of the investor ("direct investment enterprise"). The lasting interest implies the existence of a long-term relationship between the direct investor and the enterprise and a significant degree of influence on the management of the enterprise." (OECD, 1996)

Following the disappearance of commercial bank lending in the 1980s, emerging economies have eased restrictions on incoming foreign investment (Aitken & Harrison, 1999). The rationale is that host economies believe that there are benefits that can be generated from FDI. Among these benefits are: employment creation, training and higher wages, trade related benefits, technology, productivity growth and economic growth. As Table A.1 in the appendix shows, developing, emerging and developed countries offer investment incentives. Barnergie and Duflo (2005) discuss how firm productivity is determined by incentives. While incentives can be beneficial, there is a limitation in that some investors may be overprotected while others may be under protected.

This subject is not only important to the extent that it provides a platform to evaluate FDI incentive policies, but it allows us to study in depth the productivity differences in countries. In fact, it is indeed productivity differences that contribute to long term economic growth (Easterly & Levine, 2001). It is also an important policy issue to understand the factors behind the differences in productivity across developing, emerging and developed economies.

1.1.1 MNCs and FDI

Multinational Corporations[2] (Pedersen, 1998) are known to be important initiators of FDI. In 1971, Caves pointed to evidence that the multinational corporation is "the chief conduit for foreign direct investment" (Caves, 1971: 1). This is supported by statistics showing that a significant share of the global stock of FDI is owned and controlled by MNCs. Nevertheless, this identification of FDI with the MNC does not imply that they be related in absolute terms. FDI can still occur without the MNC, although such companies with outside control but no foreign corporate parent are rare. In this study we focus on MNC-born FDI. According to Alfaro, et al., (2004), the reason why most countries have

[2] The term corporation is sometimes used interchangeably with the terms enterprise, company and firm. Teece (1985) defines a multinational enterprise as a firm that has control over and manages production establishments located in at least two countries.

incentives in place to attract FDI is that FDI is envisaged to bring positive effects such as the contribution to capital formation, training of local human resources, improvement of productivity of production processes for local firms, creation of new technologies and products, and the upgrading of economic and social infrastructures in host economies.

1.1.2 Spillover mechanisms

There are indeed many benefits of MNC-born FDI as highlighted above. However, this study focuses on technology transfer and seeks to empirically test the impact of MNCs in facilitating technology transfer and hence contributing to economic growth after conditioning for the host country's absorptive capacity[3]. The focus on technology is motivated by the widely accepted view that technological change is a key determinant of "modern economic growth" (Findlay, 1978:1). In a more recent paper, Keller (2004) shows that foreign technology accounts for at least 90% of domestic productivity growth. This kind of technology is unique in that it may still be new and not yet available for purchase on the market and also that MNCs may not want to license it for competitive reasons (Mansfield & Romeo, 1980). In addition, MNCs provide human resources training and through labour turnover technology is diffused. Focusing on technological benefits that come along with the FDI renders the MNC as a knowledge processing entity.

MNCs transfer technology from their home country to affiliates (Blomstrom, et al., 1998; Gorg & Strobl, 2001; Alfaro, et. al., 2004; Romer, 1993). This technology has been identified to be an important factor that contributes to long term economic growth (Grossman & Helpman, 1991; Lucas, 1988; Romer, 1990; Levine & Renelt, 1992; Kuznets, 1966). The role of the MNC in technology transfer is clearer upon considering Kenneth Arrow's analogy. He maintains that technology diffusion is like the spread of a contagious disease, where personal contact is needed for the spread of the disease (Arrow, 1971). Likewise MNCs are important in that they facilitate the necessary

[3] Absorptive capacity in this instance is the ability of host countries to recognize, assimilate and utilize new technology from a foreign country.

locational contact required for positive technology spillovers to the host economy. Direct contact reduces uncertainties about the new technology, and increases the likelihood of technology adoption (Blomstrom & Kokko, 1998).

1.1.3 Economic growth and FDI

The subject of economic growth is also central to this research. There exists a plethora of mixed evidence concerning the relationship between economic growth and FDI in the literature. Examples of these studies include, but are not limited to Alfaro, et al., (2004) Coe & Helpman (1995), Carkovic and Levine (2002), Crespo & Velazquez (2003), van Pottelsberghe de la Potterie & Lichtenberg (2001) , Durham (2004) and Herzer, et al. (2008). Growth occurs through intentional investments in research and development that produce new technology or knowledge (Grossman & Helpman, 1991). FDI plays a role in growth by allowing countries to benefit from the knowledge that comes with MNCs (UNCTAD, 1992).

Since there is less research and development (R&D) in developing countries, knowledge spillovers[4] are likely to be an important source of technology increase and its attendant economic growth. According to Girma (2005), absorptive capacity is essential for technology transfer to occur. For this end, the study will consider absorptive capacity and it's enabling effects for FDI impacts on economic growth, particularly when critical levels of human capital, infrastructure, financial development and institutional quality are a pre-requisite. To articulate the overall essence of this study, we highlight the objectives, significance and major findings of the study, as well present layout of the remainder of the study.

[4] A spillover occurs when a firm derives economic benefits from other firms' activities without incurring a cost in undertaking that activity. The term spillover is used because foreign firms on location do not extract exclusively the complete value of their innovation and knowledge production (Kokko, 1994).

1.2 OBJECTIVES OF THE STUDY

The goal of this study is to empirically assess the contribution of MNCs towards economic growth through FDI-born technology spillovers given the host country's absorptive capacity. To this end, the following specific objectives are set:

i. To explore the productivity differences between domestic and foreign firms.
ii. To estimate the spillover effects from MNCs to domestic firms.
iii. To determine how the absorptive capacity of host countries affects the size of the technology spillovers and / or knowledge transfer from FDI.
iv. To examine the causal relationship between FDI and economic growth.
v. To investigate whether there is a difference in the growth enhancing potential of FDI inflows between developed economies, emerging market economies and developing economies.

Whilst this study hypothesizes that high FDI flows could lead to rapid economic growth, it is possible that the rapid economic growth could send a signal to investors about future profitability and hence increase the level of FDI. This necessitates the examination of causal relationships between FDI and economic growth. In 1992, the World Investment Report which focused on MNCs as engines for growth emphasized the importance of distinguishing the growth impact of FDI in middle income and low income economies (UNCTAD, 1992). In support of this point, Narula and Zanfei (2005) point out that empirical evidence shows there are more FDI spillovers in developed countries than in developing countries. The inappropriateness of pooling developing and developed countries in FDI studies is discussed by Blonigen and Wang (2004) who maintain that the basic factors that establish the location of FDI activity across countries are different across developing and developed countries. Developed countries are studied on the basis that they receive the largest flows of FDI and developing countries are of particular interest because FDI is their main source of international finance. The period of study spans from 1976 to 2006. There have been significant flows of FDI since 1976 (Basu, et al., 2003) and the year 2006 is the latest period on which data or relevant variables such as GDP, FDI and measures of absorptive capacity are available for all the selected

countries in the sample. By comparing developed, emerging and developing economies, this study contributes to the debate on the differences in spillovers after grouping countries according to their similarities.

1.3 SIGNIFICANCE OF THE STUDY

This study is topical given that most economies are now increasingly opening up to FDI. Developing countries are part of this race for FDI as they focus on achieving the Millennium Development Goals (MDGs) by the year 2015. For the set target to be met, foreign capital is required to supplement domestic capital (Asiedu, 2006). With policies put in place by many countries in order to increase FDI, it is critical that a study that investigates the contribution of FDI to growth is undertaken. This provides a decision platform for policymakers as they decide whether FDI incentive schemes are worthwhile or not. According to Fan (2003), more rigorous theoretical work is needed since FDI has not been given an important role in the growth literature. The volume of FDI inflows has increased and the source and destination countries have changed so much as to call for further research. Moreover, given the changing nature of FDI, a richer data and methodological improvements would be useful for examining the objectives of this research. There is also no consensus on the direction of causality in the relationship between FDI and growth (Lim, 2001).

Furthermore, the evidence on technological spillovers is diverse and thus calls for additional and more definitive evidence (Kinoshita & Chia-Hui, 2006; Barba Navaretti & Venables, 2004; Gorg & Greenaway, 2004). Empirical evidence supporting absorptive capacity has been found for developed countries (Kinoshita & Chia-Hui, 2006). For developing countries, the evidence is mixed. Given such a background, it will be interesting to determine the trends that will emerge after data has been analysed, particularly for developing countries where evidence is said to be diverse. Specifically, we intend to empirically disentangle the mixed results from developing countries by using various proxies of absorptive capacity, in addition to human capital which has been used in most studies: see for example Borensztein, et al., (1998) and Kinoshita & Chia-

Hui (2006). In comparison to the research on the relationship between trade and growth, studies on FDI and growth are scarce (Fan, 2003). In the light of all these concerns, the need to re-examine the role of FDI using innovative econometric procedures and substantially longer periods of data is worthwhile.

This study is related to previous studies but provides extensions in various dimensions. Specifically the countries are classified as developing, emerging and developed. We undertake an in-depth analysis of firm level data based on surveys commissioned by the World Bank Enterprise Survey (WBES) division. At the aggregate level, we apply the Toda-Yamamoto test to time series data for 37 countries, most of which have never had the test applied on them. We distinguish between the various measures of our explanatory variables and enter them in different ways into the regression equation. This helps us to check the robustness of the results. Firm level analyses as well as country level analyses are undertaken for each country grouping in the sample.

1.4 CONTRIBUTIONS AND MAJOR FINDINGS OF THE THESIS

1.4.1 Significant contributions

There are various ways in which this thesis contributes to the literature. Firstly, a thorough literature review unveils the importance of FDI as a conduit for technology transfer. The literature review chapter and the theoretical framework show that on the whole, various paradigms in the FDI theory need to be considered in analysing the relationship between FDI and productivity. Secondly, we are able to identify gaps in the literature and develop a number of hypotheses that help to unveil the relationship between FDI and productivity in a detailed manner. The third major contribution is in the empirical section where a large pool of countries is considered, developing, emerging and developed economies, all analysed both at the firm level and at the aggregate level. The study explores a wide range of countries and hence complements the existing literature by touching new ground with respect to countries that have not been studied before. The

exploration of firm level data from the World Bank Enterprise Survey presents an opportunity for new insights from very recent data. Advancing from the micro level analysis to the macro level, we explore recent time series techniques such as the Toda-Yamamoto analysis, where the causality between FDI and growth is investigated for many countries. This is followed by a dynamic panel data analysis wherein the impact of FDI on growth is further investigated using the generalised methods of moments (GMM).

Lastly, based on the informative results from the rigorous analysis carried out in this dissertation, possible policy actions are shaped for governments of developing, emerging and developed economies.

1.4.2 Major Findings

The findings from this study are informed by firm level and aggregate country level data. The following is a summary of findings from the two sets of analysis. The findings from firm level data analysis include: (1) for developing economies, productivity differences between domestic and foreign firms occur where there is less than full foreign ownership. This shows the relevance of some level of interaction if domestic firms are to benefit from foreign firm presence. The spillover analysis results show positive but statistically insignificant spillovers. (2) In the case of emerging economies, no significant differences between domestic and foreign firm productivity levels are found and no significant spillovers are measured from foreign to domestic firms. (3) Although no significant productivity differences between domestic and foreign firms are found for developed economy firms, we find highly significant spillovers. This result confirms the idea that foreign firms transfer resources to their wholly owned subsidiaries as compared to partially owned subsidiaries.

The findings from the Toda Yamamoto Granger causality tests include: (1) Growth enhancing FDI is found for Colombia, Egypt and Zambia. (2) Evidence of causality running from growth to FDI is found for China, France, Indonesia, Japan, Spain and the United Kingdom. (3) Bidirectional causality is seen in Argentina, Kenya, and Thailand

and finally, no clear cut relationship is confirmed for Australia, Austria, Belgium, Brazil, Canada, Chile, Denmark, Finland, Germany, Ghana, Greece, India, Ireland, Italy, Jordan, Madagascar, Malawi, Morocco, South Africa, Sweden, United Kingdom and United states.

The findings from the Dynamic panel data investigation include: (1) For developing economies, FDI has a positive impact on economic growth and considering the level of financial development as an absorptive capacity measure shows that higher financial development could, interacting with FDI, be harmful to economic growth. This suggests a case of harmful international capital flows where financial markets fail to regulate financial transactions/contracts of relatively esoteric nature. This result may indicate that FDI and other financial market activity are substitutes instead of complements, wherein financial markets such as money market activity is theorized to foster FDI operation by providing working capital for instance. (2) From the emerging economy analysis, the role of openness of the economy as an absorptive capacity measure is confirmed and higher financial development is also key to economic growth in this case. (3) For developed economies, we find that levels of openness above the mean value would be ideal for economic growth.

1.5 THESIS OUTLINE

As it is already obvious from the preceding chapter, the study begins with a detailed analysis of FDI trends and the distribution of FDI in developing, emerging and developed economies. This is achieved by using available data and analyzing documents published by international organizations such as UNCTAD and the Organization for Economic Cooperation and Development (OECD), the World Bank and the International Monetary Fund (IMF).

In Chapter two, we present a detailed review of the relevant literature about theories and empirical evidence on MNCs, technology transfer and economic growth. This is done so as to properly position our theory and develop hypotheses and the relevant empirical

model specifications. This aspect of the study derives from a critical review of the literature. We conclude from the review of the literature that there is no single theory, but a variety of theoretical models, explain the effects of FDI. As such, an emerging theoretical framework is illustrated in Figure 2.1. Furthermore, we conclude that the many empirical studies are largely inconclusive, hence the need for further research that investigates the contribution of FDI to the countries under study.

The method of analysis is described in Chapter three, where an attempt is made to clearly expose the underlying estimation techniques. The advantages of using one estimation technique over the other are brought out. We clearly motivate why a particular method has been selected.

In chapter four to chapter six, we apply the econometric tools, specifically cross sectional analysis of firm level data, the Toda-Yamamoto causality tests and dynamic panel data analysis, to estimate the growth equations and hence determine the spillover effects of technology to a country's growth. Stata Version 9 software is used for firm level and panel data analysis and Eviews version 6 is used for the Toda Yamamoto causality tests. Several results are presented and compared, depending on the model that was estimated. According to Temple (1999), it is important to present more than one set of results because results of a single model might be misleading. The fragility of many of the independent variables used in growth studies implies that a wider range of results should be presented.

In Chapter seven we conclude by comparing the contribution of FDI-borne technology to growth in developing, emerging and developed economies. Differences and similarities are noted. This leads us to a policy evaluation, summary of the study and implications for further research.

CHAPTER 2: LITERATURE REVIEW

> *"... unless we understand why and how a MNC invests in a country, any discussion about attracting FDI would be moot (Bhaumik, 2005: 24-25)*

2.1 INTRODUCTION

Understanding the theories of international capital flows is a crucial foundation to lay for the empirical tests of the contribution of MNCs to the economic growth of host countries. As Kugler (2000: 3) points out, the lack of evidence on positive spillovers from MNCs' FDI could be due to "… insufficient theory ahead of measurement". Since the aim of this research is to study the spillover effects of MNCs, it is imperative that we present sufficient theory before measuring. The desire to investigate MNC-borne FDI, absorptive capacity and economic growth brings into focus the complexity surrounding this topic. Such complexity cannot be unpacked from a mere review of a series of theoretical underpinnings surrounding the MNCs, technology transfer and diffusion and absorptive capacity and economic growth. Rather, this calls us to move away from such restricted linear way of thinking and analysis into a web of theories that could assist us to trace how the key conceptual issues spelt out above are linked and how phenomena surrounding them could be explained when dealing with the empirics. Hence we are aware of the need not to set out blind spots in this research by avoiding absolute subscription to a specific theory, but rather to review these theories with an open mind leading to an adoption of a set of theories either wholly or partially that will be used as analysis lenses in this study. Such positioning is advantageous in that it allows us to critique, analyze and explain data and emerging findings and come up with grounded conclusions, suggestions and/or policy recommendations.

The following sections therefore present theories surrounding MNCs, absorptive capacity and economic growth. This is done bearing in mind that a theory or group of theories can be found to be more or less useful in explaining a phenomenon or phenomena under investigation. Among some of the theories to be discussed are those pertaining to MNCs

such as industrial organization theory, the product life cycle hypothesis, transaction cost economics and the eclectic paradigm; those linked to technology transfer and diffusion such as the dynamic framework by Findlay (1978) and Das' (1987) oligopoly theory; and those that explain economic growth, including the Solow (1956) growth model and endogenous growth theories. The manner in which the theories reviewed will be utilized in the research is explained alongside the arguments that will be unfolding as discussions around certain theories open out. Finally, a conceptual framework arising from effectively dovetailed theories will be presented towards the end of the chapter. The conceptual framework will guide this research, particularly when dealing with data presentation and analysis.

2.2 THEORIES OF MNCS AND FDI

In this section, a historical background of the theory of MNCs and the MNC-born FDI is presented. An in-depth discussion of international trade and finance theories is undertaken. These theories are split into two groups: (1) theories of trade in goods and services; and (2) theories of international capital movements. This is followed by a discussion of industrial organization theories. The theories discussed under this subheading include Stephen Hymer's 1960 famous thesis and Raymond Vernon's 1966 product life cycle theory.

2.2.1 International Trade and Finance Theories

International trade and finance theories include theories of trade in goods and services and theories of international capital movements. The trade in goods and services theories include the work done by Adam Smith (1776), David Ricardo (1817) and Hecksher and Ohlin (1933) whilst international capital movements is mainly informed by the portfolio investment theory, popularized by MacDougal (1960).

2.2.1.1 Trade in Goods and Services

In explaining the reasons why nations trade, the theory of absolute advantage (Smith, 1776), the theory of comparative advantage (Ricardo, 1817) and the theory of relative differences in factor endowments (Hecksher & Ohlin, 1933) are useful. According to Smith (1776), free trade is essential if the wealth of a country is to increase. With free trade, a country should export the commodity which can be produced at lower cost and import the one produced at higher costs compared with other nations. Thus the primary source of international trade in Smith's view is the absolute advantage ushered by differences in climatic conditions, fertility and other location factors. Ricardo (1817), on the principles of political economy and taxation emphasizes the issue of efficiency in that a country should consider the opportunity cost involved in its trade decisions. In this case trade is determined by the principle of comparative advantage. In Ricardo's model, labour is the only relevant factor of production and hence there is no possibility for FDI. The Ricardian theory thus has one major drawback; it fails to explain spillovers from technology through FDI.

Hecksher and Ohlin (1933) developed the Ricardian theory of comparative advantage further and explained trade in the context of differences in factor endowments. In this model, countries specialize in goods which use intensively the most abundant factor of production and import the goods which use intensively the country's scarce factors of production. Although capital is introduced as a second factor of production, it is still immobile internationally. The failure of this model is seen through critiques that attack the unrealistic assumptions of perfect competition, two inputs which are immobile internationally and the notions of no barriers to trade and no transactions costs. In addition, Leontief found the paradoxical result in 1954 that contrary to the Hecksher-Ohlin theory, the U.S.A which was capital abundant was found to be exporting labour intensive commodities and importing capital intensive commodities (Leontief, 1954). With the assumption of immobility of factors of production, this theory fails to explain the presence of MNCs and hence the associated FDI. The theory suggests that there are

no international differences in technology and thus no room for technology transfer and spillovers.

2.2.1.2 International capital movements

The period after the Second World War was characterized by increased flows of capital. The prevailing explanation of international capital movements in this period was the neoclassical arbitrage theory of portfolio investment. The development of this theory follows closely from the works of Samuelson (1957) and Mundell (1957). This culminated in the macro-economic theory of FDI (MacDougal, 1960). In Mundell's work, foreign investment was explained in its portfolio form as opposed to the direct form[5]. The theory is based on the assumption of perfect competition. In the model, interest rate differentials play a crucial role in determining capital movements. Since there are no transaction costs, investors are able to take their savings where returns are highest and hence maximize profits. The main prediction of this theory is that MNCs will originate in countries where the marginal productivity of capital is low and transfer capital to host countries where the marginal productivity of capital is higher (Hymer, 1960).

This work, however, fails to differentiate between FDI and foreign portfolio investment. It also uses a narrow definition of foreign investment that only captures finance capital (contracts). This way, it neglects other aspects or embodiments of foreign investment such as technology, access to markets, entrepreneurship and managerial styles (Dunning, 1992). There are a number of features of FDI and MNCs that are inconsistent with the capital arbitrage theory. Such shortcomings led to the emergence of industrial organization theories. These are considered next.

[5] Portfolio investments are acquisitions of foreign shares, bonds and money market financial claims that do not give the holder a controlling stake in the assets of the claims' issuer.

2.2.2 Industrial Organization Theories

In this section a departure from the neoclassical international trade and finance theory is taken by considering Stephen Hymer's (1960) theory of the international operations of MNCs. This is followed by a discussion of the product life cycle theory.

2.2.2.1 International Operations of MNCs

Stephen Hymer (1960) took the theory of FDI out of international trade and finance into the industrial organization theory by developing what has been called a structural market imperfection theory. He focused on the MNC as the institution for international production as opposed to that of international trade (Dunning & Rugman, 1985). To provide an explanation for FDI, he noted that firms have ownership specific advantages in the form of non-financial and intangible assets. These advantages include patents and technology, scale economies, managerial skills and product reputation (brand) that MNCs would transfer across their subsidiaries. In this case the main motivation for FDI through MNCs is that MNCs want to retain control of these assets (Hymer, 1960). By establishing foreign operations, MNCs aim to appropriate all the returns from their technological advantages. Whether this appropriation is feasible or not depends on the absence of market imperfections. It was after Hymer's 1960 thesis that economists began to consider the MNC or FDI as a unique phenomenon (Vernon, 1966). The major critique of this theory is that it failed to discuss the advantages and disadvantages of FDI and its related technology transfer (Dunning & Rugman, 1985).

2.2.2.2 The Product Life Cycle

Vernon (1966) developed the product life cycle theory to explain international trade in goods and FDI. This theory pertains to the timing of investments by the MNC. The essential point here is that the MNC's main products' life cycle patterns determine foreign investment. The product life cycle involves three stages: stage 1 - an innovating country uses its technological edge to produce new products which give it an export

advantage; stage 2 - due to increased competition, production moves to lower income countries. In these lower income countries, the cost of labour might be low and therefore manufacturing from there is sensible; and finally stage 3 - the product is standardized and moves into the mature stage which induces exports. Eventually, FDI could replace exports and there could still be a possibility to export back to the home country.

The main critique of this theory follows from Buckley and Casson (1977) who maintain that corporations should take decisions simultaneously as opposed to the three stages outlined by the product life cycle. According to Teece (1985) the product life cycle hypothesis cannot be regarded as a complete theory. Organisation issues and determinants of FDI were not addressed by this theory. Given this, the search for a more informative theory continued, leading to the emergence of transaction cost economics discussed in the next section.

2.2.3 Transaction Cost Economics

The transaction cost or internalization theory was developed independently by Buckley and Casson (1976) and (Hennart, 1977). This theory has been termed the "natural market imperfection theory and internalization of market theory". The crux of this theory is that MNCs exist in order to organize interdependencies between subsidiaries in different countries (Hennart, 1977). Decision-making is based on a comparison between organizing activities through the market or through the firm. Due to market imperfections, firms incur transaction costs which they escape by using internal markets.

In the same line of research, Kogut and Zander (2003) maintain that firms internalize production because knowledge has a public good nature. This idea is centred on the importance of technology in the firms' rent seeking process. The profit maximizing MNC is interested in preventing technology spillovers to other firms in order to maintain a competitive advantage. Thus, when deciding whether or not to invest abroad, MNCs have to consider strategically the risks associated with imitation and eventual replacement of the MNC by local firms (Caves, 1971). In order for the firm to invest abroad, technology

must have the characteristics of a public good within the firm (Branstetter, 1998). Outside the firm, the technological asset must be a private good which, though non-rival in nature, is completely excludable. This difficulty in completely appropriating all new technology-generated benefits results in investors' reluctance to engage in research and development (R&D) (Pigou, 1932). In this case, these spillovers are considered to be negative to the innovative firm.

The internalization theory, however, has also faced several critiques. Amongst them is the fact that the analysis in the internalization theory is static rather than dynamic. The theory is static in the sense that it concentrates on current assets and disregards future assets. The failure to consider non-economic variables such as social and political aspects renders the theory incomplete. To address some of the pitfalls highlighted here, the eclectic paradigm by John Dunning which is the subject of the next section provides some answers (Dunning, 1980; 1981; 1993).

2.2.4 The Eclectic Paradigm

The integrative framework provided by John Dunning (1980; 1981; 1993) brings the various theoretical traditions of international production into more general frameworks. The industrial economics theory is captured by the focus on **o**wnership factors **(O),** international trade theory by **l**ocational factors **(L)** and the **i**nternalisation theory **(I)** by market failure factors. Combining these theories, Dunning came up with the OLI factors that produce a more comprehensive understanding of FDI and MNCs' behaviour. This is known as the Eclectic Paradigm or the Ownership-Location-Internalisation (OLI) framework. Dunning's initial research questions involve why firms invest overseas as well as what the determinants of the amounts and composition of international production are.

Ownership advantages answer the question of why firms go abroad and how it is possible to do so. These advantages are competitive advantages including size, monopoly power, better resource capability and usages, advantages of being part of a multi-plant enterprise,

such as economies of scale and multinationality, wider opportunities and ability to exploit differences in factor endowments. These advantages offset the disadvantage of not being a local firm and are also called competitive or monopolistic advantages. Location advantages address the question of why firms choose to produce in one country rather than in another. The emphasis is that it is more profitable for the firm to use its *O* advantages together with factor inputs outside the home country. Other advantages include spatial distribution of inputs and markets, transport and communication cost and government intervention. Internalisation responds to the how or by which route question. This includes the use of *O* advantages internally rather than lease or export into the foreign market.

The components of the OLI paradigm are the three conditions that determine whether or not a firm would engage in FDI. The selection criteria amongst the options of engaging in FDI, exporting and licensing within the OLI framework are presented in Table 2.1.

Table 2. 1 The MNC channels for serving the foreign market and the OLI paradigm

Channel \ OLI	O	O + I	OLI
Licensing	Yes	No	No
Exporting	Yes	Yes	No
FDI	Yes	Yes	Yes

Source: Dunning (1981:111)

In the O column (Table 2.1), one finds that if the firm has only ownership advantages, the firm can choose among licensing, exporting or FDI indifferently. If these ownership advantages can be internalised successfully, then the firm will not license but is still indifferent between exporting and investing directly. Combining the three advantages, OLI leaves the firm with one major option, which is FDI. The OLI framework hypothesizes that FDI occurs when three conditions are met. These are ownership, location and internalisation advantages.

The OLI paradigm is validated by empirical findings of (Arora & Fosfuri, 2000; Brouthers, et. al., 1999). One critique of the OLI theory is the Kojima Hypothesis (2003)

which is an extension of the neoclassical theory of trade. The theory takes into consideration cross-border transactions of intermediate skills such as technology and managerial expertise. The eclectic framework is criticised for being too micro-oriented and hence failing to actively influence policy. Furthermore, Smeets and de Vaal (2005) maintain that it is a paradox that the OLI specifies that MNCs invest in host economies so as to minimise the spillovers and yet the MNCs are the sources of the spillovers since FDI is a spillover mechanism. This resulted in the emergence of theories such as the investment development path.

2.2.5 The Investment Development Path Theory

Using the OLI paradigm as a base, Dunning (1981; 1986) developed the investment development path theory (IDP). This theory predicts a U-shaped relationship between a country's level of economic development and net outward flows of FDI. The U-shaped curve is explained by three stages. Firstly, the low income stage characterised by low FDI inflows and minimal outflows. Low outward FDI occurs in this instance because domestic firms' ownership advantage is not yet developed whilst low inflows follow the fact that location advantages are not strong enough to provide incentives for inward FDI inflows. Secondly, economies whose location advantage has improved are in this stage. In this stage, there are increased FDI inflows whilst outward FDI is still minimal. Thirdly, net outward flows are still negative but increasing. In the fourth and final stage, FDI outflows are greater than inflows, an indication of the fact that domestic firms have increased their ownership advantages. Empirical applications of the investment development path include the work by Barry, et al., (2003). In their study, FDI inflows and outflows are analysed for Ireland and are found to be consistent with IDP theory.

2.2.6 New Trade Theory and the Knowledge Capital Model

Another informative theory is the new trade theory. In explaining the reason why a country would choose foreign production rather than exports, the *proximity-concentration*

trade off (PCTO) is used. In this case, producers analyse the costs of FDI compared to trade costs. The PCTO gave rise to the concepts of horizontal and vertical FDI. In this case, horizontal FDI refers to a situation where a MNC replicates the same production over different locations (Markusen, 1984). Vertical FDI refers to a situation where a MNC locates production stages according to factor costs (Helpman, 1984). According to Markusen and Maskus (2002) the distinction between horizontal and vertical FDI is important in the study of FDI and MNCs.

2.2.7 Summary of the theories

The theories discussed in the foregoing sections are summarized in Table 2.2. Following Razin (2003), these theories are classified into macro-level theories, micro-level theories and an integrated framework that combines the macro and micro frameworks.

Table 2. 2: Economic Theories of MNCs

Macro-level Theories	Micro-level theories	An integrated framework
International trade theory • Neoclassical trade theory (Hecksher, 1919; Hecksher & Ohlin, 1933; Ohlin, 1935;Ricardo, 1817; Smith, 1776) • New Trade theories and the knowledge capital model.	*The Global Reach School* • Industrial organization theory (Hymer,1960; 1970) • The product life cycle hypothesis (Vernon, 1966; 1979) • Transaction cost economics/Internalization theory (Buckley & Casson, 1976; Hennart, 1977)	*The Eclectic Paradigm* • OLI factors O - Ownership L – Location I – Internalization • Investment development path theory (Dunning, 1977; 1981; Dunning & Rugman, 1985; Dunning, 1986; 1993)

Source: Adapted from Razin (2003)

As the discussions in the preceding sections have shown, the relevance of each theory is assessed according to the respective historical framework. A theory is valid only to the extent that it is supported by empirical evidence. Thus far, we have focused on theories that explain why MNCs exist but these theories are not explicit on the costs and benefits

of technology transfer and diffusion, and the subsequent contribution to economic growth, which is the moral fibre of this study. The next pages are therefore devoted to addressing the aspects of technology transfer, spillovers and economic growth.

2.3 THEORIES OF TECHNOLOGY TRANSFER, ABSORPTIVE CAPACITY AND ECONOMIC GROWTH

2.3.1 Technology Transfer

MNCs are among the main sources of technology transfer from the home country to host countries of subsidiaries. An earlier model of FDI and technology transfer is that by Findlay (1978). In his study, he related technologically advanced countries to technologically backward countries. He used the idea brought forth by Gerschenkron (1962) which posits that the greater the development gap between the industrialized economies and backward countries, the faster the catch up rate. Thus, Findlay (1978) hypothesized that the rate at which technology is diffused to backward economies is an increasing function of the gap existing between the technologically advanced country and the backward nation. However, the model lacks in explaining the forces behind technology transfer from the advanced region to the backward region.

Das' (1987) oligopoly theory explains technology transfer from the parent firm to the subsidiary. This analysis includes technology spillovers from MNCs to domestic firms in the host country of subsidiaries. Das maintains that in spite of the leakage to domestic firms, the MNC subsidiary still benefits from technology transfer from the parent company. Wang and Blomstrom (1992) consider endogenous development of international technology transfer. In the model, the strategic interaction between the MNC and the local firm determines technology transfer. The model is important in that it considers the spillover costs of technology transfer to the MNC.

Once the MNCs have transferred technology to their subsidiaries, technology diffusion to host country firms becomes possible. The nature of technology as partially excludable

makes these technology spillovers possible. Arrow (1962a) was the first to recognize that knowledge spills over from one country to another due to the public good nature of knowledge and he characterized knowledge as non rivalry and non excludable. Whilst investors who risk failure to completely appropriate all the benefits of their investment may view technology spillovers as negative, we argue that if these spillovers are outside the firm, they are not necessarily negative as they contribute to the economic growth of the host country. Whilst some studies have taken the technology spillovers to be inevitable, this automatic diffusion of technology in the host economy is subject to criticism (Fan, 2003). This study aims to investigate the existence of such spillovers.

In order for the host country to realize technological benefits from MNCs, the transfer must occur more swiftly and cheaper than the alternative methods of technological diffusion through free flow of discoveries, licensing of patents, knowledge and transfer of embodied technology through trade (Caves, 1974). There are two basic forms in which technology can be transferred: (1) technology embodied in physical assets such as tools, equipment and blueprints; and (2) required methods of organization, quality control and other manufacturing procedures that make the embodied technology useful (Teece, 1981). There are also various ways in which knowledge or technology spillovers have been defined (Table 2.3). These definitions play an important role in determining the practicality of variables in the empirical section.

Table 2. 3: Taxonomy of knowledge/technology spillovers

Author	Types of Spillovers	
Penrose (1956)	*Objective knowledge* This knowledge is explicit and examples include market data, legislation and export procedures. This kind of knowledge can be traded in the market.	*Experiential knowledge* Experience cannot be transmitted. It produces a subtle change in individuals and it cannot be separated from them.
Griliches (1979)	*Knowledge spillovers* Arise purely from the process of research and development (R&D). Typically from the mobility of workers and exchange of information at conferences and reverse engineering.	*Rent spillovers* Resulting from imperfect price adjustments following quality improvements of goods and services. Associated with exchange of goods and services.
Glaeser, et al., (1992)	*Marshal-Arrow-Romer Porter type* These spillovers are generated as firms in the same industry communicate. The mode of communication includes face to face discussions, telephone, research papers and staff turnover.	*Jacobian spillovers* Involve learning across sectors. They are between sector learning externalities.
Grunfeld (2002)	*Embodied Knowledge* These spillovers are preserved in goods and in workers.	*Disembodied knowledge* Related to intangibles such as services
Keller (2004); Powell and Grodal (2005).	*Active knowledge spillovers*. This is easily codified knowledge in the form of blueprint knowledge such as patents. It is preserved in more tangible forms such as books, CD-Roms and data files	*Passive knowledge spillovers* These spillovers are difficult to obtain because only some elements of the knowledge or technology can be transferred. Tacit knowledge related to intangibles such as experience, routines and norms is embodied in workers and hence difficult to transfer.

Source: compiled by author

An alternative way to overcome the hurdles of measurement is to consider the volume of FDI as an indicator of spillovers. To this end, it is recognized that there are three main spillover channels. These are demonstration effects, labour turnover and vertical linkages. The spillover potential of FDI depends on the type of FDI, that is whether FDI is undertaken through licensing, joint ventures or full ownership. Table 2.4 presents the different types of FDI and the associated spillover channels (Smeets & de Vaal, 2005). It is evident from the table that a joint venture has the highest potential for spillovers through the three main channels of spillovers.

Table 2. 4: FDI Types and Spillover Channels

	Licensing	Joint Venture	Full Ownership
Demonstration effects	X	X	
Labour Turnover		X	X
Vertical Linkages	X	X	

Source: Smeets and de Vaal (2005:8)

It is important to note that not only positive spillovers are obtained. There may be negative spillovers if MNCs compete with local companies for domestic demand and also take the high quality labour.

2.3.2 Absorptive Capacity

Having discussed the various forms in which technology transfer occurs from one country to the other, we now turn to studying whether the receiving end is able to absorb the technology, a phenomenon known as absorptive capacity (Abramovitz, 1986; Cohen & Levinthal, 1990; Nelson & Phelps, 1966). There are several studies that have attempted to estimate the size of spillovers from FDI and most of these studies hypothesize that the incidence of spillovers depends on absorptive capacity (Cohen & Levinthal, 1990). Thus, instead of asking only the question of whether FDI leads to economic growth, the focus is also on the enabling conditions for this relationship to materialise.

2.3.2.1 Absorptive capacity at the firm level

There are numerous ways of measuring the absorptive capacity of a given country as reflected in the literature. The definitions differ depending on whether the study in question is a cross country analysis or a firm level study. In the latter case, one example is the study by Girma (2005) where absorptive capacity was measured as the distance of the firm from the technology frontier firm. In this case, a firm operating close to the technology leader is said to have high absorptive capacity.

2.3.2.2 Absorptive capacity for the country

The bulk of the evidence on absorptive capacity appears on country level studies. Amongst these are indicators such as per capita income (Blomstrom, et al., 1994), trade openness (Balasubramanyam, et al., 1996), the level of education that the labour force has attained (Borensztein, et al., 1998), the level of development of financial markets (Alfaro, et al., 2004), technology use efficiency (Fagerberg, 1994; Henry, et al., 2003) and domestic research and development (R&D) (Griffith, et al., 2004; Kneller, 2005; World Bank, 2001). The importance of R&D in expanding the technology frontier is discussed by Aghion and Howitt (1992) and Grossman & Helpman. (1991).

The dominant variable in most studies is the level of education of the labour force. Abramovitz (1986) has called this "social capability" and other authors simply refer to it is a threshold level of human capital. Human capital is usually measured as the cumulative effect of activities such as formal education and on the job training (Romer, 1990; Heckman, 1976; Rosen, 1976). Borensztein, et al., (1998) found FDI to be positive but insignificant until after considering the minimum threshold stock of human capital. This study considers different indicators of absorptive capacity, over and above the human capital variable that most studies have used.

2.3.3 Economic Growth Theories

In this section, we link technology transfer, absorptive capacity and economic growth by reviewing the relevant literature. Our objective is to review studies that reflect the non-rival nature of technology and hence present the opportunity for technology spillovers to occur.

The Solow growth model (Solow, 1956) is the workhorse for most economic growth studies (Romer, 1996). With the objective of exposing the relationship between growth and technical change, Solow assumed exogenous technological change. The main results of the Solow model are that growth is explained by capital accumulation and technological progress. However, technological progress is left as an unexplained residual. The challenge posed by the Solow model is that of further understanding the nature of technology or the determinants of stocks of knowledge (Langlois & Robertson, 1996). In the Solow type models, FDI is conceived as an addition to the capital stock and hence given the same treatment as domestic capital. In this framework, the impact of FDI on growth is the same as that of domestic capital (Campos & Kinoshita, 2002).

There are a number of studies that have alluded to the importance of knowledge accumulation to economic growth. Amongst these is the work by Arrow (1962a) who pointed out that increasing returns occur because of the discovery of new knowledge which occurs as investment and production takes place. Similarly, Kuznets (1966) points to the successful application of MNCs' stock of knowledge as key to the economic growth of host countries. The body of literature that links these knowledge spillovers to economic growth is endogenous growth theory. Table 2.5 presents some of the growth models, grouped according to the way they treat externalities. The externalities considered here include knowledge accumulation by firms or human capital as well as externalities from the introduction of new products (Klenow & Rodriguez-Clare, 2004). These new products are in the form of new varieties or significant improvement of existing goods.

Table 2. 5: Growth Models by Type of Externalities

Type of Externality	*New Product Externalities*	*No New Product Externalities*
Knowledge Externalities	Stokey (1988; 1991) Romer (1990) Aghion and Howitt (1992) Eaton and Kortum (1996) Howitt (1999; 2000)	Romer (1986) Lucas (1988; 2004) Tamura (1991) Parente and Prescott(1994)
No Knowledge Externalities	Riviera-Batiz and Romer (1991) Romer (1994) Kortum (1997)	Jones and Manuelli (1990) Rebelo (1991) Acemoglu and Ventura (2002)

Source: Klenow and Rodriguez-Clare (2004:47)

This study is informed mainly by theories that exhibit knowledge externalities. The discussion that follows reflects this bias. Romer (1986) modelled endogenous growth resulting from knowledge externalities. His model shows that increasing returns and long run growth are possible because of knowledge externalities. Romer was however not sure whether the knowledge capital in his model should be viewed as disembodied. That is, it is not clearly specified as knowledge in books or embodied in capital goods or human capital.

The Learning by doing model by Lucas (1988) was more specific about the nature of knowledge capital. In this case Lucas emphasized the importance of human capital. His technical change is considered to be a result of experience in goods production. The role of the MNC in this particular framework would be to provide learning opportunities to the local employees and thus contributing to the improvement of human capital and in turn contributing to economic growth.

Apart from theories that deal with technology and growth, there are others that seek to explain FDI and growth (Fan, 2003). One such model is a dynamic two country model by Wang (1990). The major hypothesis in this theory is that the growth rate of human capital and technology diffusion are important factors in reducing the steady state income gap. In the same year, Romer (1990) in his model of endogenous technological change shows

that an economy with a larger stock of human capital will grow faster than those with lower stocks. With this finding, he concludes that freer international trade could speed up the growth process. This difference in levels of human capital could also explain the differences in growth levels between developing, emerging and developed countries, an aspect this work seeks to explore as well.

2.3.3.1 Firm Level Studies

A number of empirical studies on FDI spillovers have been carried out at the firm level. Examples of firm level studies include the works of Caves (1974), Aitken & Harrison (1999), Djankov & Hoekman (2000), Kinoshita (2000) , Branstetter (2001), Girma (2001) and Haskel, et al., (2001). Caves (1974) studied Canada and Australia with the objective of testing for the presence of allocative efficiency, technical efficiency and technology spillovers from FDI. For Canada, he tested the hypothesis that the share of the market held by subsidiaries corresponds to lower profits earned by domestic firms. The results confirmed this hypothesis by showing that profits in the manufacturing industry varied inversely with the concentration of foreign subsidiaries. In the case of Australia, he tested the hypothesis that productivity levels are higher in sectors that have higher shares of MNCs. Indeed he found that higher subsidiary shares correspond with productivity improvements in competing native firms.

In 1999, Aitken and Harrison studied Venezuela for the period 1976 -1989. In this study, the correlation between foreign equity participation and plant productivity was evaluated. They purported to find out whether or not there are spillovers from joint ventures to domestic plants. The study found no positive effects on domestic firms. Increased FDI and total factor productivity of domestic plants were found to have a negative relationship and gains were only found in joint ventures. Djankov and Hoekman (2000) found that the influx of multinationals has a negative impact on the productivity of local firms in Czech Republic. Studying the same country for the period 1995-1998, Kinoshita (2000) set to determine the effects of FDI on firms. No spillovers were found from inward FDI. Girma, et al., (2001) studied the British electronic industry for the period

1980-1992 and tested whether plant productivity growth is systematically correlated to the ratio of foreign owned plants to all plants in a given four digit industry and by foreign investor country. No spillovers were found from the U.S in the British electronic industry.

From the few representative studies summarised in this section, it appears that most of the firm level studies focus on the manufacturing sector because it is the sector where international knowledge spillovers are more likely to materialise. While firm level studies might be desirable insofar as their ability to capture the interaction of MNCs with host country firms is concerned, the firm level data is hard to come by. Thus most researchers resort to specifying spillover production functions which are estimated on aggregated industry or national level data.

2.3.3.2 Sectoral Studies

According to Kholdy (1995), spillovers occur as a result of direct interaction of the investor and the host country. Based on this, it may then be better to study industrial clusters as opposed to nations. Very few empirical studies capture this effect due to data limitations. Some of these studies are summarised in this section and they include the works of Globerman et al., (1994), Haddad and Harison (1993), Kokko (1994) and Baldwin, et al., (2005).

Globerman (1975) studied Canadian industries with the objective of evaluating the existence of FDI spillover benefits from manufacturing industries. He found that the degree of foreign ownership influences labour productivity. Haddad and Harrison (1993), in a study of the Moroccan manufacturing sector, for the period 1985–1989, tested whether or not productivity growth is affected by foreign presence. They found evidence that sectors with high levels of foreign investment have a lower dispersion of productivity levels across firms. Kokko (1994) studied the Mexican manufacturing sector and found that in sectors where the market share of the MNC is not too high, there is positive

correlation between foreign presence and domestic firm productivity. Whilst sectoral or industrial based studies are the second best to firm level studies in terms of disaggregating data and therefore accuracy in explaining MNCs and spillovers, there is limited data availability. This is one of the reasons why other researchers would opt for country level studies. In section 2.3.3.3, attention is paid to such studies which often take the form of cross sectional or panel data specification.

2.3.3.3 Cross Country Studies

There are several studies that rely on country level aggregated data. Country groupings vary from study to study and for the purpose of this study, the countries are split into developing, emerging and developed economies. Some of these studies are summarised in this section as an indication of research efforts on country level studies.

2.3.3.4 Developing Country Studies

The ever-increasing desire for FDI in developing countries is partly influenced by the belief that FDI leads to economic growth and also augments the much needed capital in order to achieve millennium development goals. The causality issues between FDI and economic growth have been investigated by several authors. De Mello (1997) provides a survey of developing country studies and for African countries, Baliamoune (2002) and Niar-Reichert and Weinhold (2001) provide a detailed survey. Some of the informative studies in this section include the prominent researchers such as Kholdy (1995), Borensztein, et al., (1998) and Ramirez (2000).

Kholdy (1995) undertook Granger causality tests for a set of developing countries. He found that the causality between FDI and economic growth was running from growth to FDI and not vice versa. Using a different set of countries and time frame, Borensztein, et al., (1998) studied 69 developing countries for the period spanning from 1970 to 1989. They found out that FDI inflows by themselves only marginally affected growth, but FDI

interacted with the level of education of a country's labour force had a positive significant impact on growth. Thus positive spillovers depend on the level of human capital. Ramirez (2000) found that FDI spillovers have a positive effect on labour productivity growth in Mexico.

2.3.3.5 Developed Country Studies

Developed countries generally have better quality and coverage of data when compared to developing countries. Thus studies in developed countries are able to cover a wide range of aspects where different variables are required for measurement of the issue under study. The studies reviewed in this section show various ways of capturing the contribution of MNCs to economic growth by showing studies focusing on total factor productivity growth, return to R&D investments and FDI spillovers (Savvides & Zacharadias, 2005).

Bernstein (1996) measured and decomposed TFP growth so as to estimate productivity gains and social rates of return to R&D investment associated with international spillovers between Canada and the U.S.A manufacturing industries. In the U.S.A. domestic spillovers were found to generally contribute relatively more to productivity gains than international spillovers whilst in Canada the international spillovers contributed more. In another study focusing on spillovers occurring through foreign R&D, Coe and Helpman (1995) studied 21 OECD countries plus Israel for the period 1971–1990. The aim was to determine the impact of domestic and foreign R&D capital stocks on a country's productivity level.

Studies using patent citations as indicators of technology transfer include the works of Globerman et al., (2000) and Branstetter (2001). Globerman et al. (2000) focused on the MNCs in Sweden in 1986. They relate patent citations to inward FDI from the cited countries and outward FDI to the cited countries. Using a conditional logit estimation framework, they estimate a robust correlation between outward FDI and patent citations and none on the inward side. Branstetter (2001) analyses patent applications and patent

citations between the U.S and Japan and finds that more FDI is associated with more patent citations. Data on patent citation is not readily available. As a result, an approach that uses patent citation cannot be adopted in this study.

2.3.3.6 All Three Levels of Development

There are cross country studies that lump together developing, emerging and developed economies. Such studies often cover very large sample sizes and rely on panel data estimation techniques. In a study investigating the relationship between U.S outward FDI and productivity growth in the host country, Xu (2000) used a sample size of 40 developed and developing countries. The study results showed a positive correlation between productivity growth and the ratio of subsidiary value added to host country GDP. The effect was more robust in developed than in less developed countries. Other studies that include both developed and less developed countries show significant growth promoting knowledge spillovers from advanced to less developed countries (Coe et al, 1997). Chowdhury and Mavrotas (2003) studied 80 countries made up of both developed and developing countries and examined the causality between FDI and growth. The method used is panel data estimation techniques which will be discussed at length in Chapter 3. This study combines developed, emerging and developing countries. Considering the fact that these groups of countries have different characteristics that call for separate attention, we move further to analyse these three country groupings separately.

2.4 EMERGING THEORETICAL FRAMEWORK

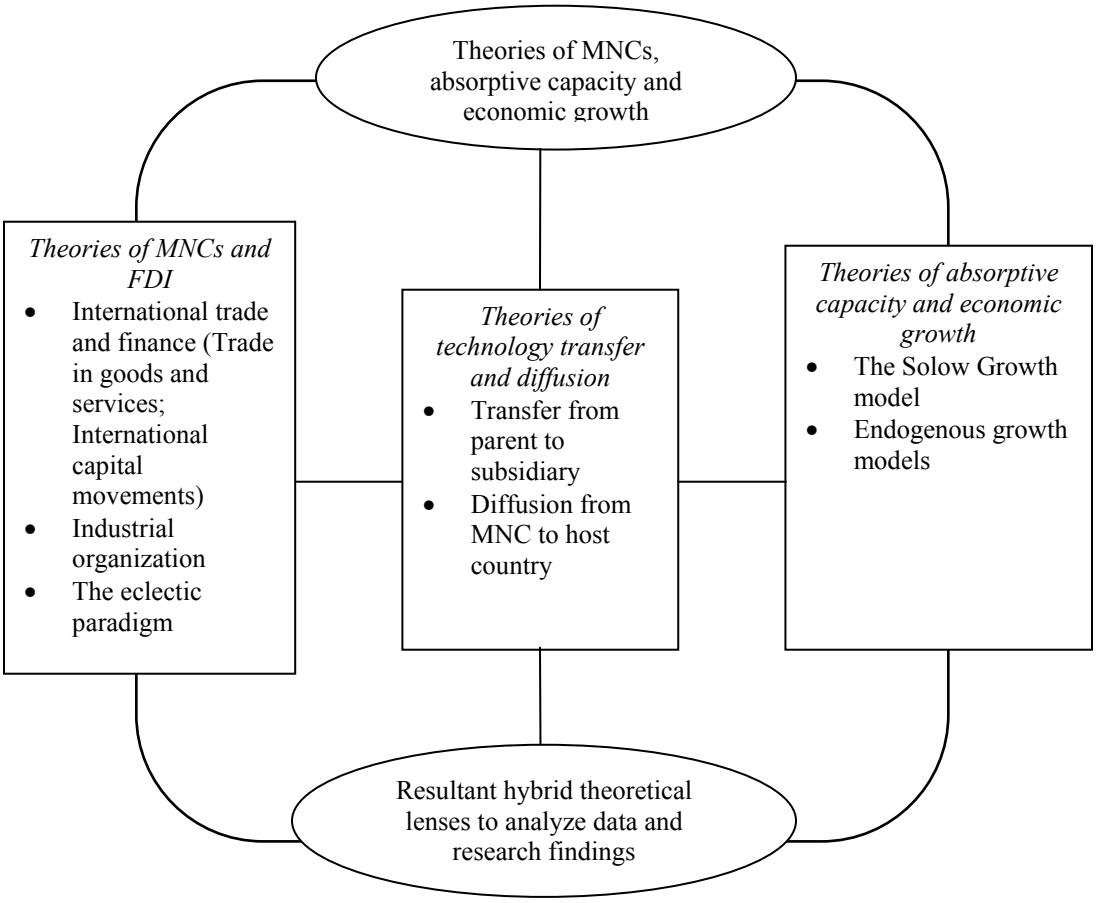
The work on theories attempting to explain the impacts of MNCs, and hence, FDI on host countries has not been put in a clear cut form of advantages and disadvantages (Latocha, 2004). The difficulty in summarizing the theories arises from the fact that host countries and investors have different reasons for undertaking investments. On one hand, investors have a profit maximization objective. On the other hand host countries allow FDI with

the hope that they will boost the supply of capital, close the technology gap, increase export earnings, increase employment as the demand for workers increases, and improve the quality of human capital and fuel development in their less developed areas (Kugler, 2000).

For this end, the theoretical review concerning MNCs, technology transfer and diffusion, absorptive capacity and economic growth undertaken in this chapter culminates in the solidification of one key fundamental: that is the fact that we cannot discuss theories of MNCs without looking into theories informing technology transfer and diffusion. Similarly, we cannot analyze theories informing technology transfer and diffusion without relating them to theories surrounding absorptive capacity and economic growth. Ultimately, one cannot further elaborate on theories explaining absorptive capacity and economic growth without considering the set of theories utilized in explaining MNCs as well as technology transfer and diffusion, and vice versa. It is a web of intertwined relationships of theoretical underpinnings!

As highlighted in the introduction to this chapter, the insights from the web of relationships between and among these theories mean that the three sets of theories explaining MNCs, technology transfer and diffusion, absorptive capacity and economic growth need not be considered in isolation. Rather, any explanation of phenomena emerging from MNCs, technology transfer and diffusion, absorptive capacity and economic growth benefits immensely from being informed and explained by a hybrid theoretical orientation. Such a hybrid approach enhances our capacity to analyse, critique and explain the complexity surrounding the research topic under consideration as shown in Figure 2.1.

Figure 2. 1: Emerging Theoretical Framework



We draw insights from even the smallest, partial contribution that the reviewed theories can make towards the disentangling and unpacking of relationships that will emerge when presenting and analyzing potential in-bound FDI data. This is how the bottom cell in Figure 2.1 culminates in us opting to adopt the hybrid theoretical framework. This kind of theoretical positioning removes blind spots that might result from us selecting a particular theory, which might suffer glaring inadequacies when it comes to explaining complex findings from this kind of research. Thus, the multiple theoretical lenses from the conceptual framework given in Figure 2.1 provide us with a more comprehensive analysis platform with which to present and analyze data, including the interpretation of emerging research findings.

2.5 CONCLUSION

The key focus of this chapter was to trace theoretical underpinnings and linkages of MNCs, technology transfer and diffusion, absorptive capacity and economic growth. This has been done with a resulting proposition that a single theory would not be useful in explaining complex web of important connections that are characteristic of this research topic. Among some of the theories discussed are those pertaining to MNCs such as the industrial organization theory, the product life cycle hypothesis, transaction cost economics and the eclectic paradigm; those linked to technology transfer and diffusion such as the dynamic framework by Findlay (1978) and Das' (1987) oligopoly theory; and those that explain absorptive capacity and economic growth, including the Solow growth model and endogenous growth theories. The chapter concludes by coming up with a hybrid theoretical framework. Such a framework appears to be useful in assisting us to understand, explain, analyze and critique inbound MNC-born FDI data and the emerging research findings.

With regards to the empirical evidence, we have identified a number of studies that ignore the possibility of a long run relationship between growth and FDI. Some studies also fail to address the issue of cross country dependence. There is a myriad of findings in the literature, with some studies confirming a positive relationship between FDI and growth while others failing to find any significant relationship. The differences in findings are attributed to different econometric modelling techniques, variable specifications, countries included in the studies and the different timeframe adopted for the studies. In Chapter 3, we shift focus to an in depth discussion of the methodology used in this study.

CHAPTER 3: METHODOLOGY

3.0 INTRODUCTION

This study seeks to investigate whether MNC-borne FDI contributes to productivity at the firm level and ultimately to economic growth and if so to what extent the contribution is dependent on absorptive capacity. The task now is to develop methods of analysis that address the objectives of the study. This chapter presents in detail the methodology issues. The chapter is made up of five sections. In section 3.1 the model and hypotheses are specified. This is followed by the discussion on data types, sources and variables in section 3.2.; sample selection in section 3.3; estimation techniques in section 3.4 and lastly the chapter summary, section 3.5.

3.1 HYPOTHESIS AND MODEL

Four models of analysis are developed in this section, mainly informed by insights from the literature review chapter. The four main models comprise of 1) a model of productivity at the firm level, testing the impact of the presence of foreign firms on domestic firms; 2) model testing causality between FDI and economic growth and 3) a model to test the relationship between growth and absorptive capacity.

3.1.1 Hypotheses

Hypothesis formulation is guided by the theoretical framework developed and the empirical literature. To this end, the following hypotheses are spelt out.

H1: Foreign firms are more productive than domestic firms.

H2: The presence of foreign firms has a positive impact on domestic firm level productivity

H3: FDI has a positive impact on economic growth.

H4: There is a critical level of FDI required for FDI to be beneficial to economic growth.

H5: There is a critical level of human capital necessary for FDI to have a positive impact on economic growth.
H6: There is a critical level of financial development necessary for FDI to have a positive effect on economic growth.
H7: There is a critical level of openness necessary for FDI to have a positive effect on economic growth.
H8: There are different effects between developing, emerging and developed countries for H1 to H7.

Foreign firms are characterized by high levels of technology. Thus, we expect that the presence of foreign firms will influence the productivity of local firms. The assumption is that FDI creates employment, enables technology transfers, and increases competition in the host economy and hence contributing to higher productivity of firms and economic growth. Levels of FDI differ within economies and hence we anticipate the impact of FDI to be different depending on the level of foreign investment. While we expect FDI to have a positive impact on economic growth, this is expected to work through various absorptive capacity measures including human capital, level of financial development and the degree of openness of the economy. All the issues discussed here are summarized by hypotheses H1 to H8.

3.1.2 Model Specification

Two approaches are considered in this study. The first approach is a cross sectional analysis of firm level productivity as influenced by the presence of MNCs. This involves cross sectional regressions at the firm level, where firm characteristics explain productivity differences. The second approach is a time series cross sectional analysis where heterogeneity across units over time is investigated. Whilst a cross sectional analysis on its own might tell us that FDI is beneficial to the majority of countries in a sample, without time series analysis we cannot tell how this FDI impact is in the time space.

3.1.1.1 A Model of firm productivity

To analyse MNC spillovers econometrically, a productivity function is specified where the dependent variable is total factor productivity (Savvides & Zacharadias, 2005) and the independent variables include the presence of MNCs in the same industry (horizontal spillovers), the age, size and capital intensity of the firm. The basic specification is shown in equation 3.1.

$$\ln LAP_i = \beta_0 + \beta_1 \ln CAPIN_i + \beta_2 \ln LAB_i + \beta_3 OWN_i + \beta_4 EDUC_i + \beta_5 SIZE_i + \beta_6 AGE_i + \beta_7 IND_i + \beta_8 COUNT_i + \varepsilon_i \quad (3.1)$$

Where I indexes firms, CAPIN is capital intensity, LAB is the number of employees, OWN is the ownership variable, EDUC is the level of education, SIZE is the size of the firm, AGE is the number of years in operation, IND measures industry type and COUNT is the dummy variable for country of origin. This empirical analysis relies on data from the World Bank Enterprise Surveys for selected countries.

3.1.1.2 A Model of Economic Growth

Equation 3.2 is a generic model from which various specifications will be developed. Whilst the key explanatory variables are initial level of GDP, FDI and human capital, it is important to control for additional determinants of economic growth in order to reduce the problem of omitted variables. However, some variables are excluded due to data limitations and the issue of degrees of freedom available in the short time series framework. The selection of variables therefore rests on the hypothesis we wish to test. Since the accurate model of economic growth is not known, we experiment with a number of specifications.

$$GROWTH_{it} = \beta_0 + \beta_1 HUMCAP_{it} + \beta_2 FDI_{it} + \beta_3 OPEN_{it} + \beta_4 EXRATE_{it} + \beta_5 INFRATE_{it} + \beta_6 FINDEV_{it} + u_{it} \quad (3.2)$$

where: *i* indexes countries and *t* indexes years. HUMCAP is the human capital; FDI is foreign direct investment; OPEN is a measure of openness; EXRATE is the exchange rate; INFRATE is the inflation rate; FINDEV is the level of development of financial institutions. The dependent variable in the model is economic growth which is measured by GDP growth rates. In this model we have assumed that causality runs from FDI to economic growth and not the other way round. Hansen and Rand (2004) maintain that whilst FDI and growth have a positive relationship, the direction of causality is not known. This is, however, an issue that can be tested using our data. There are two specific questions to be answered with respect to the causality issue; (1) Does FDI cause long run growth and development? (2) Does economic growth attract FDI as MNCs seek new markets and profit opportunities? The methods for causality tests are discussed in detail in section 3.4.

In growth equations, it may be necessary to study the movement from one steady state to another. To introduce dynamics into the analysis, equation 3.2 is modified by introducing a lagged dependent variable $GROWTH_{i,t-1}$. The new models allow knowledge spillovers to have both a short run and a long run impact on growth (Falvey, et al., 2002). This dynamic model is shown in equation 3.3.

$$GROWTH_{it} = \alpha_i + \beta_1 HUMCAP_{it} + \beta_2 FDI_{it} + \beta_3 OPEN_{it} + \beta_4 EXRATE_{it} + \beta_5 INFRATE_{it} + \beta_6 FINDEV_{it} + \beta_7 GROWTH_{i,t-1} + u_{it} \quad (3.3)$$

3.1.1.3 Growth and Absorptive Capacity

In this section we include interaction terms in the model so as to capture the importance of absorptive capacity (ABSCAP). The model is specified with an interaction term of FDI

and the variable that reflects absorptive capacity. The use of the interaction term allows the return to FDI to depend on absorptive capacity (equation 3.4).

$$GROWTH_{it} = \alpha_i + \beta_1 HUMCAP_{it} + \beta_2 FDI_{it} + (\beta_3 FDI_{it} * ABSCAP) + \beta_4 OPEN_{it} + \beta_5 EXRATE_{it} + \beta_6 INFRATE_{it} + \beta_7 FINDEV_{it} + u_{it} \quad (3.4)$$

In this case, four variants of equation 3.4 are estimated, with HUMCAP, OPEN and FINDEV as indicators of absorptive capacity (ABSCAP). The model of analysis is drawn from new growth theory models that capture the fact that there are multiple steady states in growth. These steady states depend on a number of factors that show the initial conditions of a country. These include the level of economic development, human capital and financial development (what we have called absorptive capacity measures in this thesis). The interactive models show that the relationship between growth and FDI varies as a function of a third variable. Given this complexity of growth relationships, multiplicative interaction becomes a possibility. According to Brambor et al (2006), there is substantial evidence that the intuition behind conditional hypothesis is captured very well by multiplicative interaction models (Wright, 1976; Friedrich, 1982 and Aitken and West, 1991). By using interactive models of the multiplicative type, the objective is to capture not only the main impact of the explanatory variables, but also their interactive (conditional) effects.

Interactive models of the multiplicative type have been criticised on the basis of the difficulty in interpretation from as early as the late 1970's (Wright, 1976; Alison, 1977; Smith & Sesaki, 1979). The major contention being that the inclusion of multiplicative interaction terms distorts the partial coefficients. Another criticism is that the inclusion of this multiplicative term leads to multicollinearity. Multicollinearity is known to have negative consequences on the quality of estimates, particularly increasing the variances of the coefficient estimates. As a result, hypothesis testing is affected, with the likelihood that a variable which would otherwise be statistically insignificant in an additive model would turn out to be statistically significant in a multiplicative model.

All these criticisms of multiplicative interaction models have since been disputed by Friedrich (1986) in his seminal paper on the defence of multiplicative models. His arguments are that the coefficients are fairly easy to interpret, with clear-cut meanings. Moreover, the multicollinearity does not cause problems for the interpretation of coefficients mainly because in a multiplicative model the relationship between variables is on conditional terms rather than general terms. He concludes that where there is a possibility of interaction, one must include the multiplicative interaction terms and that the consequences of including one are better compared to not doing so. In the extant literature on FDI and economic growth, a number of authors have formulated a multiplicative interaction models. Amongst these is Borensztein et. al (1998), Olofsdotter (1998) and Carkovic and Levine (2002). This study complements the literature that uses multiplicative interaction models to study the impact of absorptive capacity on economic growth.

3.2 DATA AND VARIABLES

Recall that the empirical literature reviewed is broad and different studies give insights on the selection of variables, how to measure them, sample selection, data sources and estimation techniques: See for example (Coe & Helpman, 1995; Bernstein, 1996). In this section we refer to the literature that helps in defining our variables and data sources. The dependent variables, independent variables, construction of variables and data sources are discussed.

3.2.1 Dependent variable

Total factor productivity has been used in some studies as the dependent variable (Coe & Helpman, 1995; Bernstein, 1996, Savvides & Zacharadias, 2005) whilst other studies have used output growth rather than TFP (Falvey, et al., 2002; Evenson & Singh, 1997; Khawar, 2005). The choice of output growth is based on the fact that errors that are likely in calculating TFP can be avoided. Moreover, one can readily compare the results with

the bulk of growth studies that use output growth as the dependent variable. In this study, real per capita GDP is considered as the dependent variable.

3.2.2 Independent variables

There are many explanatory variables that can be included in the MNC, absorptive capacity and economic growth nexus. The various combinations of variables in any one regression are as many as the number of regressions themselves as in Sala-i-Martin's 1997 paper entitled "I just ran Two Million Regressions". According to Levine and Renelt (1992), the following variables are usually included in growth equations: initial level of real GDP per capita, secondary school enrolment rate and the average annual rate of population growth. De Mello (1999) emphasizes the issue of complementarities between domestic and foreign capital. Achievement of a certain level of income in the host country also affects the FDI growth relationship (Blomstrom, et al., 1994). Other key variables include the openness of the economy (Balasubramanyam, et al., 1996) and the level of development of financial institutions (Alfaro, et al., 2004). It will also be important to capture region specific effects by including regional dummy variables (Sala-i-Martin, et al., 2004). The control variables adopted in this study are representative of those found in endogenous growth literature. Table 3.1 is a summary of variables that have been used in growth literature and the impact of the variables on economic growth.

Table 3. 1: Variables used in growth regressions

	Sachs & Warner (1997)	Easterly & Levine (1997)	Temple (1998)	Ghura & Hadjimichael (1996)	Savvides (1995)	Asiama & Kugler
Initial Income	-	+	-	-	-	-
Initial income squared	-	-				
Savings	+			+	+	+
Population growth			+	-	-	-
Literacy rate						xxx
School enrolment rate		+	+	+	xxx	
Life expectancy	+		+	+		xxx
Government consumption					-	-
Infrastructure		+	+			
Black Market Premium		-	-			
Fiscal Deficit/Surplus		+	+	-		
Socio-/Political Instability		-	-	-	-	
Openness	+		+		+	+
Geography	-		+			
Climate				-		
Natural Resource abundance	-		-			
Institutional quality	+		+	+		
Inflation				-	xxx	-
Financial Development		+	+		+	+
Dummy for Africa	+	-	-			
Foreign Direct Investment						+
Poverty						-
M2GDP						-
Neighbourhood effects	-	-				
Terms of trade				+		xxx
Real Effective exchange rate				-	xxx	
Ethnic Fractionalisation	-		-			

Notes: - denotes a negative effect on growth; + denotes a positive effect on growth; xxx denotes a non-significant effect on growth; Source: Asiama and Kugler (2005)

As many as twenty-seven explanatory variables are shown in Table 3.1. These are the variables that have been used in the literature for various reasons. We are cautious not to include irrelevant variables and hence use a more parsimonious specification wherein

only variables that have been found to be significant in other studies are used. Most of the variables identified in this section are often not readily available. In most cases, proxies are used and at times calculations are undertaken in order to define a variable. In section 3.4, different ways in which dependent and independent variables have been measured in the literature are discussed. There are instances when the proxy used in this study is adopted directly from the literature and in other cases the proxies are adapted and validation of the proxy is done.

3.2.3 Construction of variables

The review above helped in identifying the dependent and independent variables which feature in regressions concerned with the FDI, absorptive capacity and economic growth nexus. Attention is now shifted to the measurement of these variables. This exercise is done carefully, with the understanding that the selected variables or proxies often influence the outcome of estimation.

3.2.3.1 Gross Domestic Product (GDP)

GDP is defined as the value of all goods and services produced within an economy over a given period of time. This variable is reported in the various national accounts of all countries considered in this study and is available in totals, per capita terms and in growth rates. Questions are often raised as to whether the growth rate, log or level of GDP must be used in estimations. In standard neoclassical growth models, the long run relationships predicted are between the levels. Thus a model including only the growth rate of GDP excludes the neoclassical growth models by assumption instead of including these models in conjunction with endogenous growth models. Most studies of the determinants of total factor productivity or output have been based on a change, rather than levels specification. The reason is that differencing was considered as necessary to avoid the spurious correlation problem when estimating a relationship between trended variables.

The disadvantage of a change specification is that the information embodied in the long run relationship between the levels of the variables is discarded by differencing.

In this study we follow King and Levine (1993) and use real per capita GDP as our proxy for economic growth. Hansen and Rand (2004) use the log of GDP. Per capita GDP growth rates have been used by Turkcan, et al., (2008). The growth rates are used more in single pure cross sectional regressions. In most dynamic growth literature, the dependent variable is the log difference of real GDP per capita (Tsangarides, 2002, DeJong and Ripoll, 2006 and Chang et al. (2005).

3.2.3.2 Initial level of GDP

The initial level of real GDP per capita or income per capita is a measure of a country's initial conditions. This variable indicates the level of development of the country. The coefficient of this variable helps in determining the existence of convergence in income levels (the catch-up effect) implied in the standard Solow- Swan growth theory. If the coefficient is negative, the conclusion is that there is convergence and if positive, there is divergence. In this study we measure this variable as the logarithm of real per capita GDP at the beginning of the estimation period. Barro (1997) and Barro and Sala-i-Martin (2004) have shown that growth in real GDP per capita is negatively related to the initial level of GDP.

3.2.3.3 Technology spillovers

Technology transfer and the spillover effects are difficult to measure quantitatively. According to Krugman (1991:53) technology transfer and spillovers leave "no paper trail". Studies use different indicators to capture the benefits (if any) of FDI spillovers and practically the proxy selection process is influenced by data availability. Four major channels of technology transfer are identified. These are trade in products, trade in knowledge, FDI and international migration (Hoekman, et al., 2004). Technology is embedded in capital and intermediate goods so the direct import of these goods is one

channel of transmission. The use of such variables is seen in the models of Grossman and Helpman (1991) and Eaton and Kortum (2001). Whilst these are interesting variables, this study focuses on technology spillovers from FDI and thus seeks technology spillover variables that are linked to FDI. The best indicators would be ones that capture the technology aspect of FDI. Such indicators include;

1. Using FDI flows as weights for foreign R&D stocks as shown in equation (3.5) (van Pottelsberghe de la Potterie & Lichtenberg, 2001)

$$S_{it}^{LP} = \sum_{j \neq i} \frac{FDI_{ijt}}{K_{jt}} \cdot R_{jt} \qquad (3.5)$$

Where: FDI_{ijt} is the flow of FDI received by country *i* from country j in the period t, K_{jt} is the stock of physical capital of country j, and R_{jt} is the stock of technological capital of country j. Close to this line of thinking is the work by Savvides and Zacharadias (2005) who measure foreign R&D intensity in each developing country as a weighted average of the R&D intensity of each of the five major advanced economies (G-5) where the weights are the shares of each LDC's technology imports from each of the G-5.

2. Royalty and license fees paid by MNC foreign affiliates as a percentage of host country GDP (Xu, 2000)
3. The ratio of FDI inflows to GDP (Borensztein, et al., 1998)

If the three indicators above were readily available, one could use them interchangeably in different estimations and observe the changes in the results. However, the only variable that is readily available for all countries in the sample is the FDI inflows. Thus we follow Borensztein et al. (1998), and use the ratio of FDI inflows to GDP as a proxy for technology spillovers. FDI is defined either as a flow variable or as a stock variable. These two measures are different in that, FDI stocks display a much less volatile behaviour over time than FDI flows (Sala-i-Martin, et al., 2004). The limitation associated with the use of FDI inflows as a proxy for technological spillovers is that data taken from balance of payments statistics only measures the financial stake of a parent in a foreign affiliate. The question is then how the financial stake can represent MNC activity. In response to this, Lipsey (2001) argues that stocks of FDI tend to be fairly

closely correlated with MNC employment and sales in the host country. Thus in the absence of a first best proxy, balance of payments FDI data can be used as a proxy for the magnitude of MNC activities in the host country, although they are an imperfect measure.

Carkovic and Levine (2002) use gross FDI inflows. They extracted the exogenous component of FDI. Hansen and Rand (2004) use FDI as a percentage of GDP. They also use FDI as a percentage of gross fixed capital formation (GFCF). There are studies that have used FDI per capita growth rates (Turcan, et al., 2008). In this study we use FDI inflows as a percentage of GDP.

3.2.3.4 Human Capital

The role of human capital in economic growth has been highlighted in the path breaking work by Uzawa (1965) and Lucas (1988). Empirical studies investigating the contribution of human capital to economic growth have flourished in the literature. There are studies that have found little or no relationship between human capital and economic growth, such as Benhabib and Spiegel (1994), Barro and Sala-i-Martin (1995). Some studies have taken a micro econometric approach and estimated returns to schooling (Psacharopoulos (1994), Lucas (1988), Romer (1990), Mankiw, et al., (1992) and Levine & Renelt (1992).

Other studies have emphasized the necessary conditions for FDI to affect economic growth: that is, the absorptive capacity effects. Among these studies are the works of Borensztein, et al., (1998) who emphasize that the host country's education must exceed a certain threshold for FDI to be beneficial to economic growth. According to Benhabib and Spiegel (1994), human capital plays a dual role in promoting TFP growth: 1) the ability of education to influence productivity by determining the capacity of nations to innovate new technologies suited to domestic production, and 2) as a determinant of technology absorption (Benhabib & Spiegel, 1994:145). If the domestic workforce lacks sufficient schooling, this hinders the transfer of skills from MNCs to the employees. While some studies have found positive impacts of education on growth, others have not (Carkovic and Levine, 2002).

This "social capability" variable is measured by the level of schooling for the population 25 years and over (Heckman, 1976; Rosen, 1976; Fagerberg, 1994; Henry et al., 2003; Blomstrom, et al., 1992; Abramovitz, 1986, Romer, 1990). Whilst the average years of schooling of the working age population is a common measure of human capital, it is a quantity variable that does not reflect on the quality of education. A good attempt at taking quality into consideration is shown by Crespo and Velazquez (2003). Their indicator for the stock of human capital, which takes into account the existence of quality differences between educational levels using expenditures per student, is reproduced in equation (3.6).

$$H_t = \sum_{i=1}^{3} GPE_{i,1995} \cdot DUR_{i,t} \cdot PNE_{i,t} \qquad (3.6)$$

where: $GPE_{i,1995}$ is the public and private expenditure per student at educational level *i* in relation to the total average cost of training of a university student in the European Union in 1995, considering all the educational levels that she had to complete in order to obtain his or her degree. $DUR_{i,t}$ is the duration of educational level *i* in year *t* and $PNE_{i,t}$ is the percentage of population between 25 and 64 years of age that has completed educational level *i* in year *t*. This human capital variable is appealing mainly because of its ability to capture the quality of education. Nevertheless, we cannot adopt this measure in our study due to data constraints. Instead, we use an alternative which is the labour force with secondary education. Secondary education is considered because it lays a foundation for lifelong learning and human development by offering more subject or skill oriented instruction.

In order to capture the absorptive capacity effect Kinoshita & Chia-Hui, (2006) use an interaction variable that captures the joint effect of FDI and school. In this case the hypothesis would be that a more highly educated workforce can better take advantage of foreign R&D induced ideas and is more likely to use capital goods imports (embodying advanced foreign technologies) more effectively. Another option, creatively formulated by Carkovic and Levine (2002) is to use a dummy variable D, where D=1 if the country

has greater than average schooling and zero otherwise. In this case the interaction term would be FDI*D. In this study we use the Barro and Lee (2001) data on the average years of schooling for population aged 15 years and over. Our expectation is that this human capital measure has a positive relationship with economic growth.

3.2.3.5 Openness

It is generally accepted that openness is an important factor in accelerating economic growth. A more liberal trade regime encourages a favourable investment climate that promotes economic growth. In addition, as the economy opens up, market access is widened. This variable also captures the external technological effects on economic growth, as it comes with exposure to a larger set of ideas or technologies (Winter, 2004). The issue of how the openness variable contributes to economic growth is basically an empirical question (Balassa, 1982; Michaely et al. 1991; Pritchett and Sethi, 1994; Edwards, 1997 and Sala-i-Martin, 1997). Other measures of openness can be found in the work of Dollar (1992) who uses the index of real exchange rate distortion and variability. Learner's (1988) openness index, average import tariffs (Barro & Lee, 1994) and the Heritage foundation's index of distortions in international trade. Some indices of trade orientation have also been used by Dollar (1992), Sachs and Warner (1995), Harrison, 1996, Edwards (1998) and Frankel & Romer, 1999.

The common measure of openness is the ratio of exports plus imports to GDP. However, Balasubramanyam, et al., (1996) argue that export and trade shares may not capture the degree to which a country is "open" because the trade volume is determined by a number of characteristics beyond trade policy. The fact that policymakers cannot directly alter the trade volume makes it difficult to draw policy implications from the results where this variable is used. This variable has also been criticised by Winter (2004) based on the fact that it does not indicate the extent of trade policy. Another indicator of openness is the Sachs and Warner (1995) indicator of openness to international trade in which a dummy variable is defined; where (0) represents a closed economy with average tariffs higher than 40% and (1) an open economy. This trade liberalisation index is based on exchange

rates and commercial policies, tariffs and non-tariff barriers, the black market premium, the share of trade in GDP and movements towards international prices. Whilst this is a good proxy, the index does not cover the years that are considered in this study. At the same time, updating the index is beyond the scope of this study. We resort to the usual proxy of the total of exports and imports divided by GDP, bearing in mind the limitations of the variable. We expect openness to be positively related to economic growth. Kawai (1994) use trade openness as one of the explanatory variables and confirmed the importance of conditioning for trade openness to obtain the growth effect of FDI.

3.2.3.6 Financial Markets development

The contribution of financial deepening (FINDEV) to economic growth has been widely documented in literature (Burnside & Dollar, 2000; Collier & Gunning, 1999a; Collier & Gunning, 1999b; Easterly & Levine, 1997; Hausmann, et al., 2005; Levine, 2003). Not only is financial development recorded as a key element of growth, but also as an indicator for absorptive capacity in the FDI – growth literature. Hermes and Lensink (2003) argue that the development of the financial system of the recipient country is an important precondition for FDI to have a positive impact on economic growth. In other studies, Alfaro, et al., (2004) and Alfaro & Charlton (2007) use financial institutions as a proxy for absorptive capacity or what they call "local conditions". Their argument is that lack of developed financial institutions can limit the country's ability to take advantage of potential FDI spillovers.

This financial development variable has been operationalised in different ways in the literature. There is a wide range of variables used, such as the amount of private credit to the private sector, stock market capitalisation, the total value of stock trades, stock market turnover ratio, the ratio of M2 to GDP (monetisation variable), ratio of bank deposit liabilities to nominal GDP and the ratio of bank claims to the private sector to nominal GDP. This list is not exhaustive and we give a few cases to illustrate how these variables have been used. Durham (2004) uses the total stock market capitalisation relative to GDP as a measure of financial market development. The alternative would be to use bank

based financial sector development measures such as domestic credit to the private sector provided by the banking sector as a share of GDP (Hermes & Lensink, 2003; Beck et. al., 2000). The credit to the private sector is considered to be an accurate proxy as it reflects the magnitude and quality of investment. The variable has been however criticised based on its exclusion of transactions occurring outside the banking sector. However, as Ghirmay (2005) points out, this critique can be ignored within the developing country framework as there are hardly financial developments outside the banking sector.

The principal component method can also be used for the variables: labour force employed in the financial system, share of the financial system in GDP and the variable money and quasi- money (M2) as a ratio of GDP (M2/GDP) (Graff & Karmann, 2006). M2 represents the liquid liabilities of the financial system and has been criticised for measuring the extent to which transactions are monetised rather than the functions of the monetary system. In a study investigating the role of financial development on economic growth in South Africa, Odhiambo (2004) use three proxies of financial development, namely, the M2 to GDP ratio, the ratio of currency to narrow money and the ratio of bank claims on the private sector to GDP.

We adopt the principal components methodology to get our proxy for financial development using three indicators. Using this method, we get the common variance of the three indicators. The advantage of the principal components analysis is that it creates a new variable that comprises more information and is a better representation of financial development. In addition to the computed financial development index, we enter the different types of financial development indicators separately into the regression equation. Our expectation is that this variable is positively related to economic growth.

3.2.3.7 Inflation

There is liberal evidence in the literature showing that inflation impacts on growth negatively (Fisher, 1993). The rationale for including inflation as an explanatory variable in the growth equation is that inflation impedes efficient resource allocation as it obscures

the signaling role played by relative price changes and increases uncertainty (Temple, 2000). Inflation is an indicator of domestic fiscal and monetary prudence and indicates macro economic instability. High inflation rates are said to increase the complexity of contracts which causes negotiation times to increase and the avoidance of some contracts (Heyman and Leijonhufvus, 1995). We expect higher inflation levels to have a negative impact on economic growth. The variable inflation is calculated from CPI and is taken from the WDI (2007).

3.2.3.8 Macroeconomic policy

We use the three macroeconomic policy indicators (openness, government size and inflation) to construct the macroeconomic policy index that will be collectively used as an absorptive capacity measure. In this context, we have extended the FDI-Growth literature by constructing a composite "local conditions", borrowing the phrase from Alfaro, et al.,(2004) who only used financial development as the absorptive capacity variable (section 3.2.4.7). Macroeconomic instability has also been indicated by high inflation rates and excessive budget deficits (Kormendi and Meguire, 1985; Fisher, 1993; Bleaney, 1996; Sadni Jallab, et al., 2008).

3.2.4 Data

This study relies on two data sets, one for the firm level study (the World Bank Enterprise Surveys) and a dataset for time series cross country analysis (the World Development Indicators, 2007). For the firm level analysis, we use firm level data from a cross-section of developing, emerging and developed countries. The data is from the World Bank Enterprise Surveys carried out between 2002 and 2007. Firms from each of the countries were sampled randomly and stratified by firm size and broad 2-digit industry. Attrition in this dataset is random because of imperfect reporting. Some countries are eliminated based on the absence of a significant number of firms with foreign ownership exceeding 10%. Firms with zero sales, employment, material inputs or

investment and not satisfying basic error checks are also excluded. We check for outliers, coding mistakes and meaningless observations. We are able to compare these enterprise surveys from different countries because the sampling strategies and survey instruments are similar. Thus we treat the data from the different countries as a pooled cross section of firms. The WBES dataset is rich and yet research based on the data is minimal. This work will be useful as a background study to inform further research as more enterprise survey data are released so as to form a panel dataset.

The dataset for the time series cross-sectional analysis comprises of 37 countries, amongst them 9 developing countries, 12 emerging economies and 16 developed countries. The data covers the period from 1975 to 2006, which is selected conditional on data availability. Caution is given by Folster and Henrekson (2001) that annual data should be avoided in growth studies. The reason is that the results may be affected by short run business cycle effects. In order to circumvent the short run business cycle effects, we follow a number of authors who have used data that is averaged over 5 year periods rather than annual data (Caseli, et al., 1996; Islam, 1995; Johnson, 2006; Carcovic & Levine, 2002; O'Connell, 1998; Harrison, 1996). This gives us six non overlapping five year periods to work within our time series cross sectional analysis. We also use three year averages in the estimation as done in the study by Njikam, et al., (2006).

There is however debate over the issue of averaging data, with some authors opting to take the data for the first year in the group, e.g. taking every fifth year observation in order to avoid the additional serial correlation that can arise from averaging. In cases where data for a large number of countries is available, growth regressions have typically taken averages over long periods such as 20 years. According to Barro (1991), averages of five years, ten years or longer are taken in order to smooth out business cycle effects. Averaging over shorter periods like five years is said to result in loss of information. Additionally, it is affected by the lack of synchronicity in country business cycles which does not purge five year averages from cyclical influences (Bassanini, et. al., 2001). Burnside and Dollar (2000) used four year averages. We compute three year averages for

1975 through 2006. Our panel then combines data in three year blocks as follows: 1975-1977, 1978-1980… 2004-2006. We also include five year averages as; 1975-1979, 1980-1984… 2005-2006 (the last observation is an average of two observations only. The potential dimensions of the panel would be 9x7; 12x7 and 16x7 for developing, emerging and developed economies respectively. The actual dimensions turn out to be smaller due to missing observations. The analysis also includes the long annual panel that enables us to analyse data at the highest possible frequency.

The main source of data is the World Bank's World Development Indicators (WDI, 2007) for variables such as GDP, population, FDI, gross fixed capital formation (GFCF), exports, imports, inflation and exchange rates. Some of the variables are drawn from the International Monetary Fund's (IMF) International Financial Statistics (IFS). The United Nations Conference on Trade and Development (UNCTAD) has data published in its annual World Investment Report (WIR). This report provides data for FDI flows, FDI stocks and the share of FDI in GDP. The data is collected directly from national official sources such as central banks and statistical offices of individual economies.

With regards to the data quality, the IMF ensures that data are of the highest possible quality by providing guidelines of the Balance of Payments Manual which reporting countries are expected to follow. There are, however, problems as some countries fail to comply with the manual's specifications. Temple (1999) warns about data quality problems and thus calls for consistency checks in the different data sets. In this study, we heed this warning by relying on one main source of data, the (WDI, 2007) for as many variables as possible and only turning to other sources where a particular variable is not found in the WDI.

3.3 SAMPLE SELECTION

The question of which countries should be analysed is a crucial one in time series cross sectional analysis (Kittel, 1999). Developed countries are studied on the basis that they receive the largest flows of FDI. Whilst it is true that developed countries reflect a high

concentration of R&D, foreign sources of technology are important contributors to productivity growth in the developed economies (Savvides & Zacharadias, 2005). Emerging economies provide a classic example of the change over conditions from developing to developed economies, and they too receive a significantly high level of FDI flows. Thus studying emerging economies is essential in policymaking, in particular for developing economies aspiring to advance onto that category. Developing countries are of particular interest because FDI is their main source of international finance. In addition, developing countries carry very little R&D and therefore technology transfer through FDI is likely to be of particular influence on economic growth. A summary of samples from studies covering developing, emerging, developed and a combination of the three economies is shown in Table 3.2.

Table 3. 2: Samples and Study Periods from the Literature

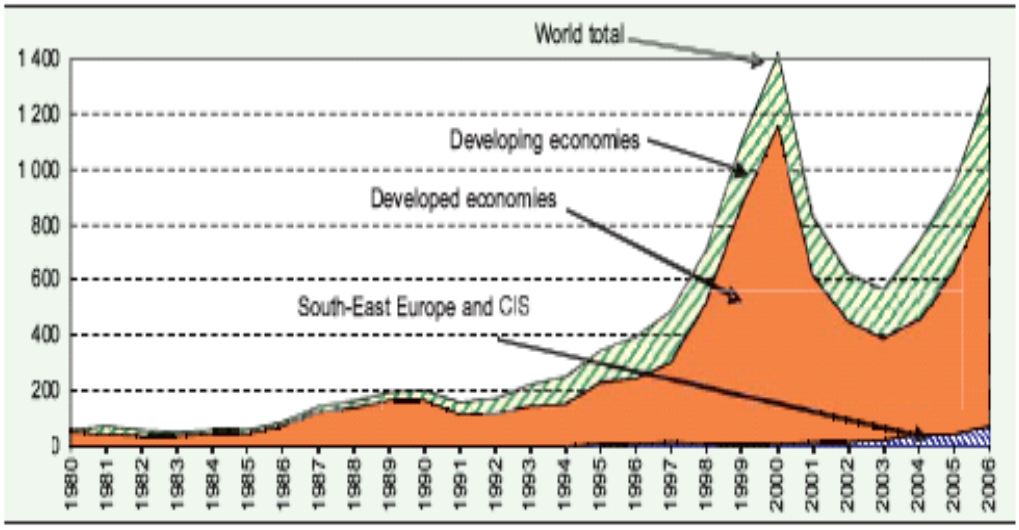
Author	Study Period	Countries in Sample
Developing Country studies		
Borensztein, et al., (1998)	1970-1979; 1980-1989	69 developing countries
vanPottelsberghe de la Potterie & Litchenberg (2001)	1970 – 1985	46 developing countries
Choe (2003)	1970 – 1994	119 developing countries
Savvides & Zacharadias (2005)	1965 – 1992	32 developing countries
Hansen and Rand (2004)	1970 – 2000	31 developing countries
Emerging economy studies		
Falvey, et al., (2002)	1990 – 1998	25 Transition economies
Developed Country Studies		
Balasubramanyam, et al., (1996)	1971 – 1990	21 OECD plus Israel
Crespo & Velazquez (2004)	1987 – 1999	28 OECD countries
Mixed Sample		
Coe, et al., (1997)	1971 – 1990	22 developed countries and 77 developing (FDI recipients)
Campos & Kinoshita (2002)	1966 – 1994	40 countries, about half more developed and half less developed
Oliva & Rivera-Batiz (2002)	1973 – 1990	5 donors (OECD) and 52 recipients
Chowdhury & Mavrotas (2003)	1971 – 1995	80 countries, a mixture of developed and developing countries.

Most authors write without justifying their sample size and the selected time frame and a few authors mention that they are often limited by the availability of data. A major problem encountered when classifying countries into different categories is that countries may appear in two different classes for two different listings. For instance, the economist includes Hong Kong, Singapore and Saudi Arabia in the emerging economy listing,

whilst Morgan Stanley Capital International (MSCI) considers these countries to be developed. In some cases, a country is kept in one class to ensure continuity in the index even when the country has graduated from developing to emerging economy status.

The selection of countries into the three categories: developing, emerging and developed can be based on the growth rate of GDP, the volume of FDI or the number of MNCs in the country. Other selection criteria may be the strength of the currency value, population and geographical spread. The inappropriateness of pooling developing and developed countries in FDI studies is discussed by Blonigen and Wang (2004). Lumping countries into one sample implies that they have the same production technology and this is an unrealistic assumption. Figure 3.1 shows that indeed developed and developing countries show a significant difference in their FDI flows.

Figure 3. 1: FDI Inflows, Global and by Group of Economies, 1980-2006 (Billions of dollars)



Source: (UNCTAD, 2007:3)

Table 3.3 shows the criteria used for classifying countries into four groups by various organizations such as the IMF, the World Bank, Morgan Stanley Capital International (MSCI) and the economist. Classification of countries differs across institutions. The common practice in the literature is to use the World Bank classification that separates countries according to income levels and results in four different classes; viz: low

income, lower middle income, upper middle income and high income countries. This study desires to analyse a class of countries labelled, developing, emerging and developed economies. A close look at these countries shows that they are a combination of lower middle income countries and higher middle income countries. Thus these "middle class" countries based on the World Bank classification are what we have called "Emerging economies". There is however confusion likely to arise based on the fact that these emerging economies are in essence developing economies and hence the classification of developing, emerging and developed might be questionable to some. We have however reserved the term developing to mean low income countries[6] and have restricted the sample to sub-Saharan African for parsimony as well as data constraints and the common belief that the region is structurally different from the rest of the world.

There are 9 developing countries selected. The emerging economy sample consists of 12 countries and the developed country sample has 16 countries. All these countries are some of the most important actors on the world market. After taking into consideration the availability of data and ensuring that countries are selected based on common macroeconomic episodes, policy regimes, and growth patterns, institutional and cultural characteristics a sample is presented in Table 3.3. This harmonization of country characteristics ensures that generalisations made based on regression results can be applied across the sample.

[6] Note that Botswana is classified as a lower middle income country in the World Bank Classification. We have however classified the country as developing, together with low income countries.

Table 3. 3: Classification of Countries

Developing Countries /Less Developed countries (Dollar, 1992)/ Least Economically Developed Countries (LEDCs)/ Underdeveloped Nations/ Third World Nations/ Non-industrialised nations			**Developed Country/ Most Economically Developed Countries (MEDCs)/ First World Nations/ Industrialised Nations**
Developing	*Emerging Market Economies (a term coined by Antoine W. Van Agtmael in 1981)*	*Newly Industrialised Country (NIC). Term began to be used in the 1970s when the Asian Tigers rose to global prominence with rapid industrial growth since the 1960s.*	
• Low standard of living • Moderate to low per capita income • Low value added sectors such as Agriculture and natural resource extraction	• Maintained sustained economic growth than other developing nations • Exhibit good economic potential • Transitional , i.e. in the process of moving from a closed to an open market economy (hence not stable) and from developing to developed status • Embarking on economic reform programs. • Increase in both local and foreign investment (Durham, 2004). • Some emerging economies defined as "rapidly developing economies" • BRICs (Goldman Sachs investment bank thesis that these countries will match developed country economies by 2050 • BRIMC	• More advanced economies than other developing nations • Not fully industrialised • Emerging markets whose economies have not yet reached first world status but have outpaced their developing counterparts • Undergoing rapid economic growth (usually export oriented) • Incipient (embryonic) or ongoing industrialisation • Increased social freedoms and civil rights • Switch from agricultural to industrial economies • Increasingly open market economy • Large national corporations operating in several continents • Strong capital investments from foreign countries. • Political leadership in their area of influence	• High standards of living • Economic systems based on continuous, self sustaining economic growth • Tertiary and quaternary sectors

Table 3. 4: Developing Country Sample

Africa	North, Central America & the Caribbean	Asia	Oceania	South America
Angola	Antigua and Barbuda	Afghanistan	American Samoa	**Bolivia**
Benin	Bahamas	**Bangladesh**	Christmas Island	**Colombia**
Botswana	Barbados	Bahrain	Cocos (Keeling) Islands	**Ecuador**
Burkina Faso	Belize	Bhutan	Cook Islands	**Guyana**
Burundi	**Costa Rica**	Brunei	East Timor	Paraguay
Cameroon	Cuba	Burma	Fiji	Suriname
Cape Verde	Dominica	**Cambodia**	French Polynesia	**Uruguay**
Central African Republic	**Dominican Republic**	People's Republic of China	Guam	Venezuela
Chad	**El Salvador**	India	Marshall Islands	
Comoros	Grenada	Indonesia	Micronesia	
Cote d'Ivoire	**Guatemala**	Iran	Nauru	
Democratic Republic of Congo	Haiti	Iraq	Niue	
Djibouti	**Honduras**	Jordan	Norfolk Island	
Equatorial Guinea	**Jamaica**	Kuwait	Northern Mariana Islands	
Eritrea	Nicaragua	Laos	Palau	
Ethiopia	Panama	**Lebanon**	Papua New Guinea	
Gabon	Saint Kitts and Nevis	Malaysia	Pitcairn	
Ghana	Saint Lucia	Nepal	Tokelau	
Kenya	Saint Vincent and the Grenadines	North Korea	Tonga	
Lesotho	Trinidad and Tobago	Oman	Wallis and Futuna	
Liberia		Pakistan		
Libya		Philippines		
Madagascar		Qatar		
Malawi		Saudi Arabia		
Mauritius		Sri Lanka		
Morocco		Syria		
Mozambique		Thailand		
Namibia		**Turkey**		
Niger		**Yemen**		
Nigeria		**Vietnam**		
Rwanda				
Senegal				
Seychelles				
Sierra Leone				
Somalia				
Sudan				
Swaziland				
Tanzania				
Togo				
Tunisia				
Zambia				
Zimbabwe				

The countries in bold in Table 3.4 are in the World Bank enterprise survey sample. Having identified the countries of interest, that are both developing and have firm level enterprise data, we are still faced with additional sample selection criteria. For the macro level analysis, a major constraint is time series data availability. Due to data problems the final sample is different from the targeted sample because the quality of data for some countries is considered as unreliable. We restrict our sample to African Developing countries, of which Angola, Cape Verde, Eritrea, Ethiopia, Mauritius, Namibia and Tanzania fall out due to lack of variables of interest in our data set. Thus the developing country sample is effectively made up of Benin, Burkina Faso, Botswana, Burundi, Cameroon, DRC, Ghana, Kenya, Lesotho, Madagascar, Malawi and Zambia.

The current research efforts in emerging economies have focused on different groups of countries based on certain characteristics. The groupings have resulted in creative acronyms such as BRICS (Brazil, India, China and South Africa), CIBS (China, India, Brazil and South Africa) and CIMBS (China, India, Mexico, Brazil and South Africa). There is increasing focus on different groups of emerging economies in literature. The emerging economy sample for this study is presented in Table 3.5. Whilst the study aims at grouping emerging economies together, it will also be interesting to check the regression results for the different sub-groupings in further studies.

Table 3. 5: Emerging Economies Sample

Emerging Economies	
Argentina	Mexico
Brazil	**Morocco**
Chile *(rapidly growing)*	Pakistan
China	Peru
Colombia	Philippines
Czech Republic ***(developed past the emerging market phase)***	Poland
Egypt	Russia
Hungary	South Africa
India	South Korea *(developed past the emerging market phase)*
Indonesia	Taiwan (developed past the emerging market phase)
Israel *(developed past the emerging market phase)*	**Thailand**
Jordan	Turkey
Malaysia *(rapidly growing)*	

Out of the 25 emerging economies shown in Table 3.5, 13 have firm level enterprise survey data. Those countries are selected as a representative sample of emerging economies and are in bold in Table 3.5. The 13 countries are Argentina, Brazil, Chile, China, Colombia, Czech Republic, Egypt, Hungary, India, Indonesia, Jordan, Morocco and Thailand.

Most economic growth studies that have considered developed countries have focused on the OECD countries. In this category of developed economies, data availability is not a major constraint as there are rich data sets for all these countries. The selected countries in the developed country class are shown in Table 3.6.

Table 3. 6: Developed Economies Sample

Australia	Netherlands
Austria	Japan
Belgium	Luxembourg
Canada	*Netherlands*
Cyprus	New Zealand
Denmark	Norway
Finland	Portugal
France	San Marino
Germany	Singapore
Greece	Slovenia
Hong Kong	*South Korea*
Iceland	**Spain**
Ireland	*Sweden*
Israel	Switzerland
Italy	*Taiwan*
Japan	*United Kingdom*
Luxembourg	*United States*

Only four developed countries, Germany, Greece, Ireland and Spain in the sample in Table 3.6 have firm level enterprise survey undertaken by the World Bank. Thus the firm level analysis will be carried out for the three countries. For time series cross sectional analysis, we select 16 developed countries so that the comparison with developing and emerging economies is meaningful.

In terms of the time frame, as shown in Table 3.2, the reviewed studies show different time frames. Although most of the studies have a common source of data, there is no

clear indication of the basis for choosing the different study periods. In this study, we consider data availability for the three different strata: developing, emerging and developed. For developing and emerging economies, data is generally not available before 1975. However, for developed countries data is available from around 1970. Since one of the key objectives of this study is to undertake a comparative study of the three classes of countries, we consider the period from 1975 to 2006. This is a relevant time period as it caters for the fact that spillovers are not instantaneous and hence the period of 32 years enables us to draw statistically meaningful results from time series cross-sectional data.

3.4 ESTIMATION TECHNIQUES

This section discusses the econometric techniques used to estimate the models presented earlier in this chapter. In order to achieve the objectives of this study, it is noted that time series analysis will only cover a long historical context and no spatial framework. As a result, the method adopted is time series cross-section analysis, with both the historical context and a cross section of countries. Similar studies that focus on the effect of FDI on economic growth have a tendency to ignore simultaneity bias, country specific effects and the use of lagged dependent variables. This results in biased coefficient estimates and standard errors. This study has an empirical focus with the objective of applying econometric techniques that eliminate these biases. In addition to new statistical techniques, new databases are used which cover the latest period for which data is available.

3.4.1 The Causal relationship between Economic Growth and FDI

In the models specified in equations (3.1) and (3.2), it might be the case that there is reverse causality. Instead of FDI fostering economic growth, causality might run from growth to FDI. With such reverse causality, the use of Ordinary Least Squares (OLS) (Folster & Henrekson, 2001) as an estimation technique results in biased estimates. In this case, the estimation might

pick up the influence of economic growth on FDI rather than the hypothesized effect. Various techniques have been developed to allow causality tests. In this section we briefly describe the Granger Causality Tests and the Toda-Yamamoto tests used in the study.

3.4.1.1 Granger Causality Tests

The Granger causality tests are attributed to Granger (1969) and Sims (1972). According to Granger's definition of causality, a variable (x) Granger causes another variable (*y*) if the present *y* can be predicted better by past values of *x*. In other words, past events (past values of *x*) cannot be influenced by future events (current values of *y*) or future events. Thus, since *x* occurred before *y*, then *x* can be viewed as a cause of *y*.

3.4.1.2 Toda-Yamamoto Test

The Toda-Yamamoto test differs from the granger causality test in that it ignores non stationarity issues and cointegration when testing for causality. In this way, the risk of wrong identification of the order of integration is minimised (Chowdhury & Mavrotas, 2003). The steps involved in carrying out the Toda Yamamoto tests include: 1) testing the order of integration for both FDI and GDP, 2) using the Akaike's final prediction error (FPE) criterion to find the optimum lag structure, 3) conducting diagnostic tests to determine the presence of any misspecification in the results and 4) conducting a bootstrap simulation to investigate the performance of the Toda-Yamamoto test. In Chapter 5, the Toda-Yamamoto method is applied to the data and each of these four steps are executed and a more detailed description is given.

3.4.2 Time Series Cross-Sectional Analysis

The nature of data used in this study has both time series dimension (1976-2006) and a cross-sectional dimension (various country groupings). Although this is often referred to

as panel data, the correct description is cross-section time series analysis. Panel data is described by a short time series and a large number of cross sectional units. Whilst TSCS and panel data may have common notation, they are different. Thus, it is important to know which fixes are designed for panel data whether they can be applied directly to TSCS data. The cross-section time series analysis allows us to control for continuously evolving country specific differences in technology production and socio-economic factors. This leads to better results as compared to a purely cross-sectional analysis. The ability to control for unobserved cross section heterogeneity is the most desired feature of the cross-sectional time series analysis. Further advantages of this framework include the incorporation of more observations and hence the improvement of degrees of freedom and efficiency (Hurline & Venet, 2004).

In this method of analysis, a choice has to be made between the fixed effects model and random effects model. The fixed effects model allows focus on changes within different units over time. In this model, estimates remain unbiased even when data is missing for some years for several countries in the sample. The Hausman specification test is used to choose between the fixed effects model and the random effects model. The null hypothesis under this test is that the explanatory variables and the country specific component that does not vary over time are uncorrelated. The test statistic in this case is based on the variance-covariance matrices of the two estimators. If the null hypothesis is rejected, we use the fixed effects estimator to get consistent results. If on the other hand the null hypothesis cannot be rejected, we use the random effects estimator. We introduce country and group specific dummy variables and estimate a fixed effects model. In the random effects model, the country specific term is assumed to be random and not correlated with explanatory variables. The error term in this model may be taken to represent all unobserved variables that affect the dependent variables but are not necessarily included in the explanatory variables.

Caution must however be exercised when working with time series cross sectional data. This relates to the assumption of causal homogeneity which might lead to faulty conclusions, wherein a causal relationship in all cross sections is inferred when it is only

in a subset of cross-sections. The opposite may also occur, where the causal relationship for the entire group is rejected when it is actually present in a subset of the sample[7].

3.4.3 The Generalised Method of Moments Estimator

In order to control for simultaneity bias and country specific effects (individual heterogeneity), the analysis is set up within a dynamic panel procedure. The dynamic models include a number of lags of dependent variables as covariates. There are unobserved, fixed and random effects. In this dynamic setting, the unobserved panel effects are correlated with the lagged dependent variables. This makes standard estimators such as the ordinary least squares (OLS) approach not applicable. This correlation gives rise to inflated coefficients. It is also not efficient to use the within groups estimator (Bond, 2002; Judson & Owen, 1999; Nickel, 1981).

The general Method of Moments technique was introduced by Arellano and Bond (1991). Arellano and Bond's difference estimator eliminates country specific effects and removes omitted variable bias by taking differences. The right hand side variables are then instrumented using lagged values of the original regressors as instruments. By doing this, the inconsistency arising from simultaneity bias and the bias from the differenced lagged dependent variable is removed. The differenced estimator has been used in growth studies by Caselli, et al., (1996) and Easterly & Levine (1997). With further development of the work, Blundell and Bond (1998) introduced systems GMM. Researchers are faced with the choice of using either a first differenced GMM estimator or a systems estimator. The differenced estimator has been criticized for behaving poorly as lagged levels of the series only provide weak instruments for subsequent first differences (Bond et al., 2001). The performance of the systems GMM estimator has been shown to be better than that of the differenced estimator when data are highly persistent (Blundell and Bond, 1998). This estimator is more efficient and consistent in Monte Carlo Simulations. Authors that have used the systems estimator include Hoeffler (2002) and Beck (2002).

[7] See Hurlin and Venet (2001) for a new procedure for evaluating the character of the causal relationship within a panel data framework

The method is based on the following dynamic growth equation,

$$y_{i,t} - y_{i,t-1} = (\alpha - 1) y_{i,t-1} + \beta' X_{it} + \eta_i + \varepsilon_{it}, \tag{3.7}$$

where y_{it} is the log of real GDP per capita. X is a set of explanatory variables; time dummies are included to remove universal time-related shocks from the errors.
Equation 3.7 can be written as follows;

$$y_{it} = \alpha y_{i,t-1} + \beta' X_{it} + \eta_i + \varepsilon_{it}, \tag{3.8}$$

Differencing equation 3.8 once, we are able to eliminate country effects and remain with equation 3.9.

$$y_{it} - y_{it-1} = \alpha\left(y_{i,t-1} - y_{i,t-2}\right) + \beta'\left(X_{it} - X_{i,t-1}\right) + \left(\varepsilon_{it} - \varepsilon_{i,t-1}\right) \tag{3.9}$$

Accordingly, we modify model one (equation 3.2 and 3.3) to allow a dynamic specification (equation 3.4) which allows for the possibility of partial adjustment.

$$GROWTH_{it} = \alpha_i + \beta_1 HUMCAP_{it} + \beta_2 FDI_{it} + \beta_3 OPEN_{it} + \beta_4 EXRATE + \beta_5 INFRATE + \beta_6 FINDEV_{it} + \beta_7 GROWTH_{i,t-1} + u_{it} \tag{3.10}$$

In equation (3.10), $GROWTH_{it}$ is the per capita GDP and $GROWTH_{it-1}$ is its lagged value. FDI_{it} is foreign direct investment and X_{it} is a matrix of the following control variables: human capital, openness, exchange rate, inflation rate and financial development.

In estimating equation (3.10), we may be faced with several econometric problems. The first one is that the FDI variable is assumed to be endogenous since causality may run from FDI to economic growth and vice versa. As a result, the FDI regressor might be

correlated with the error term. The second problem is associated with fixed country effects which may be correlated with the explanatory variables. This fixed effects error is captured in equation 3.8 as η_i. The third problem is that by introducing a lagged dependent variable, autocorrelation arises.

In order to deal with the first and second problems, we use the Arellano-Bond (1991) difference GMM estimator which was first proposed by Holtz-Eakin, et al., (1988). This method uses lagged levels of the FDI (the endogenous variable) as an instrument, together with the exogenous variables. As a result, the endogenous variable is now considered to be predetermined and therefore not correlated with the error term.

The difference GMM uses first differences to transform equation 3.11 into

$$\Delta GROWTH_{it} = \beta_1 \Delta GROWTH_{i,t-1} + \beta_2 \Delta FDI_{it} + \beta_3 \Delta X_{it} + \Delta u_{it} \qquad (3.12)$$

This transformation removes the fixed country-specific effect, which does not vary with time. This is illustrated as follows;

$\Delta u_{it} = \Delta v_i + \Delta e_{it}$, where $\Delta v_i = v_i - v_i$

The first differenced lagged dependent variable is instrumented with its past levels as a solution to problem number three. The Arellano-Bond estimator was designed for small T and large N-panels. The explanatory variables are lagged by one period in order to address the simultaneity from growth to any of the explanatory variables. This is justified based on the observed reverse causalities in the literature, such as reverse causality for finance and growth and FDI and growth. With lagged dependent variables in the model, the implication is that all the estimated beta coefficients represent short run effects. In order to get the long run effects, we divide each of the betas by $1-\lambda$ (λ is the coefficient of the lagged dependent variable).

The application of pure panel data techniques such as the fixed effects and random effects model may result in biased estimations. The reason for this is that the dynamic model may introduce correlation between the error term and the explanatory variables. Arellano and Bond (1991) and Arellano and Bover (1995) provided a solution to this problem by developing the GMM estimator. This estimator tries to eliminate individual effects by means of conversion of the first differences model. This is unsatisfactory in dynamic models where the series are often autoregressive and panels are relatively short (Arellano & Bover, 1995; Blundell & Bond, 1998). The Arellano-Bond GMM estimator removes the fixed effect by taking first differences and exploiting all available lagged values of the dependent variable and the exogenous regressors as instruments, thus producing substantial efficiency gains (Judson & Owen, 1996). The advantages of the GMM estimator are that it helps to reduce the problems of multicolinearity among the explanatory variables and endogeneity between the dependent and explanatory variables (Yao & Wei, 2007; Kumar & Pradhan, 2002; Townsend, 2003; Basu & Guariglia, 2003).

The GMM method can deal with the possible simultaneity between FDI and economic growth. As a result, we are able to focus on the exogenous component of FDI on economic growth (Arellano & Bond, 1991; Arellano et al., 1995). Consistency of the GMM estimator depends on the validity of instruments. Thus we test the overall validity of instruments using the Sargan test of over identifying restrictions. We also use the serial correlation test which examines that the error term is not serially correlated. Some specification tests are used to address the consistency issue of the GMM estimator. These include the Sargan/Hansen test of overidentifying tests for joint validity of the instruments. The null hypothesis in this case is that the instruments are not correlated with the residuals. Another test is the Arellano-Bond test for autocorrelation in which the null hypothesis is that the idiosyncratic disturbance is not serially correlated.

3.4.4 Sensitivity Analysis

Sensitivity of the results with respect to estimation methods is investigated to assess the robustness of the results. This is done in several ways, amongst them are the use of a

variety of specifications; examining if the results are not influenced by a few outliers; checking for the validity of proxies by trying other variables and monitoring their performance. The following list of alternative specifications helps us to check for the robustness of the results.

1) In the firm level study, we control for industry differences when making productivity comparisons, testing the composition effect.
2) The beginning of period FDI can be substituted for the annual share to test if spillovers from FDI only appear after several years.
3) Checking whether inclusion or exclusion of country specific constants makes any difference to estimated parameters.

3.4.5 Conclusion

In this chapter, we specify the models of analyses define the test variables and identify suitable estimation techniques. Various models have been specified, starting with the basic productivity model at the firm level. This is followed by models that seek to capture the absorptive capacity effects through an interaction term of the absorptive capacity variable with the FDI variable. The estimation techniques include causality tests for FDI and economic growth, choosing between the random effects and fixed effects estimators using the Hausman specification test and finally estimating a dynamic model using the GMM estimator. The models presented in this chapter are the pillars of analysis in the empirical chapters four, five and six.

CHAPTER 4: PRODUCTIVITY EFFECTS OF FDI: EVIDENCE FROM ENTERPRISE SURVEY DATA

While the convergence theory is concerned with closing the income gap between the rich and the poor countries, at the firm level, the global productivity gap has to be bridged (ILO, 2004 -5)

4.1 Introduction

A number of countries have relaxed their fiscal and financial regulations (see Table A1, Appendix), with an anticipation of positive spillovers on domestic firms from foreign firms attracted by the liberalised investment environment. This chapter tests the existence of such spillovers, motivated by the fact that MNCs have both tangible and intangible assets that could spillover to domestic firms as implied by the standard internalisation theory (Caves, 1996). The Ownership, Location and Internalisation (OLI) paradigm reveals MNCs as firms that have ownership advantages of assets that make their performance better than domestic firms. This superiority of MNCs is also evident in the work of Buckley & Casson (1976), Dunning (1977), Hubert and Pain (2001) and Buckley, et al., (2007)[8]. FDI has been described by DeMello (1997) as a "composite bundle" of capital, knowhow and technology. As such, the impact of FDI is likely to differ across countries.

Discussions of the role of FDI in promoting growth in general, and productivity in particular, are ongoing. Whilst the effort of most researchers has been dedicated to country level studies, firm level studies have been limited by the paucity of data. A survey by Blomstrom et al. (2000) indicates that there are more studies on direct spillover effects for developing than developed countries. Given this large number of developing country studies, Goedhuys et al. (2008) observe that there are limited studies for African countries and that these studies focus on the analysis of export performance using firm

[8] Refer to chapter two for a detailed discussion of the literature

level data. It is evident from the literature reviewed that the issue of spillovers is essentially an empirical question. With this in mind, our analysis covers 25 countries in total to provide sound evidence across heterogeneous countries that can be classified as developing, emerging and developed economies[9].

A good platform for comparison across developing, emerging and developed countries is set by the use of standardised firm level World Bank Enterprise Survey (WBES) data sets. This allows for an extensive analysis of spillovers with all the sectors included. The manufacturing sector is considered to be important for economic growth. It is noted in the literature that the phenomenal growth of the newly industrialized economies is ascribed to the manufacturing sector (Dicken, 2003; Hallward-Driemeier, 2003). It has also been established empirically that the manufacturing sector facilitates technological spillovers (Kathuria, 2000). This perceived importance of the manufacturing sector, together with data limitations of other sectors has resulted in a tilted research effort towards the manufacturing sector. Unlike previous studies that focused mainly on manufacturing firms, the WBES which incorporated sectors such as services, agro industry, construction and other sectors allows us to explore productivity effects in a broader framework (Gorg & Greenaway, 2004). The literature highlights the recent shift of FDI from manufacturing to services sectors as maintained by Dicken (2003). Furthermore, the World Investment Report 2004 was entitled "Shift towards services" and shows that services account for a larger share of FDI compared to manufacturing sectors (UNCTAD, 2004).

The standardised dataset has uniform sectoral classification and thus allows for sectoral comparisons across countries. Since activities at the firm level ultimately aggregate to influence the entire economy, we can use the results from the FDI impact at the firm level and reconcile the evidence with country level studies presented in the next chapter. In the literature review, conceptual and methodological drawbacks in similar studies which often use different analytical frameworks and apply different methodologies are highlighted. In this chapter, countries are subjected to the same model and methodology to allow for reliable comparisons. The main objectives of this chapter are:

[9] The criteria and method of classification are discussed in detail in Chapter 3.

1. To examine the productivity differences between domestic and foreign firms.
2. To investigate the spillover effects of foreign presence on domestic firms.
3. To review policy options available based on the findings of this chapter.

We contribute to the literature by exploring the rich dataset of the World Bank Enterprise Survey (WBES) to examine FDI spillovers for developing, emerging and developed economies. The starting point is to estimate productivity differences between foreign owned and domestic firms for each of the countries in the sample. Once productivity differentials are confirmed, spillover effects are investigated for domestic firms. Performance differences between MNCs and domestic firms are expected as motivated by Doms & Jensen (1998), Girma et al. (2001) and McGuckin & Nguyen (1995; 2001). In order to explore productivity differences, all firms are included in the analysis. Labour productivity is regressed on the foreign ownership variable. A positive coefficient on the ownership variable confirms that foreign firms exhibit higher labour productivity. With regards to spillovers, only domestic firms are considered and the domestic firm productivity is regressed on measures of foreign presence and other control variables such as capital, labour, firm age and firm size. The coefficients on FDI regressors will determine whether we have positive or negative FDI spillovers. The remainder of this chapter is structured as follows: in section 4.2 we present the model developed, describe the estimation strategy and discuss the definition of variables. In section 4.3, we provide descriptive statistics of the data. In Section 4.5 we present the findings and conclude in section 4.6.

4.2 Model Specification

Our estimation is based on the Cobb-Douglas production function which is widely used in productivity studies (Griliches & Mairesse, 1995). We specify a production function for firms in the economy which is augmented by foreign presence and a set of control variables. A standard augmented production function used in empirical analysis is

adopted (Blomstrom & Sjoholm, 1999; Dimelis & Louri, 2004; Kokko, 1996). The production function is as shown in equation 4.1.

$$Y_i = L_i^{\alpha} K_i^{\beta} e^{\sum \lambda_i X_i + \lambda_0 + \varepsilon_i} \quad (4.1)$$

i=1,2,…,n

Where Y_i is the output of firm i, L_i and K_i and are labour and fixed capital, respectively. The output elasticities with respect to labour and capital are represented by α and β, respectively. To cater for exogenous production shocks, X_i is included in the equation, λ_0 is a constant and ε_i is an error term which takes care of unobservables. In order to get labour productivity, we divide equation 4.1 through by L as follows;

$$\frac{Y_i}{L_i} = \frac{L_i^{\alpha} K_i^{\beta} e^{\sum \lambda_i X_i + \lambda_0 + \varepsilon_i}}{L_i} \quad (4.2)$$

Multiplying numerator by $L_i^{\beta} L_i^{-\beta}$ results in equation 4.3

$$Y_i / L_i = L_i^{\alpha} L_i^{-1} L^{\beta} L^{-\beta} K_i^{\beta} e^{\sum \lambda_i X_i + \lambda_0 + \varepsilon_i} \quad (4.3)$$

Rearranging terms in equation 4.3, we get equation (4.4)

$$Y_i / L_i = \left(K_i / L_i\right)^{\beta} L_i^{\alpha+\beta-1} e^{\sum \lambda_i X_i + \lambda_0 + \varepsilon_i} \quad (4.4)$$

Taking logs, the resulting linear equation is shown in equation 4.5.

$$\ln\left(Y_i / L_i\right) = \lambda_0 + \beta \ln\left(K_i / L_i\right) + \left(\alpha + \beta - 1\right) \ln L_i + \sum_{i=1}^{n} \lambda_i X_i + \varepsilon_i \quad (4.5)$$

The X in equation 4.2 represents exogenous factors which, based on the theoretical and empirical literature reviewed, are expected to influence the output of each firm. Writing equation 4.5 with explicit exogenous factors that influence firm productivity, we get equation 4.6:

$$\begin{aligned} \ln LAP_i = {} & \beta_0 + \beta_1 \ln CAPIN_i + \beta_2 \ln LAB_i + \beta_3 OWN_i + \beta_4 EDUC_i \\ & + \beta_5 SIZE_i + \beta_6 AGE_i + \beta_7 IND_i + \beta_8 COUNT_i + \varepsilon_i \end{aligned} \quad (4.6)$$

In specification 4.4, our variable of interest, the ownership variable *(OWN)*, is discussed in detail in section 4.4.2.3. CAPIN is capital intensity, LAB is the number of employees,

OWN is the ownership variable, EDUC is the level of education, SIZE is the size of the firm, AGE is the number of years in operation, IND measures industry type and COUNT is the dummy variable for country of origin. The coefficient on ownership measures the difference between foreign and domestic productivity. We include other variables to control for technology effects, firm specific characteristics, business environment, absorptive capacity and international relations.

4.4 Data and Variables used in the regression

We use an extensive data set collected by the World Bank Enterprise Survey. The objectives of the World Bank Enterprise Surveys are to collect data that informs about business perceptions with regards to obstacles to growth, constraints to productivity and the effects of the business environment to a country's international competitiveness. These surveys were conducted by private contractors on behalf of the World Bank. The sampling process[10] involved stratified random sampling methodology. The data are mainly cross sectional, with a few countries having panel data for two years and in some cases three years. Extensive data checks were performed to ensure that the data is useful. This includes, cleaning nonsense observations, outliers and coding mistakes. The characteristics of the sample are presented in Table 4.1. Although countries have been classified into three broad groups, the countries remain heterogeneous as they are influenced by different economic, political and institutional setups.

[10] For a detailed sampling process visit http://www.enterprisesurveys.org/

Table 4. 1: Enterprise Survey Data Summary

Country	Year of survey	No. of firms	Small <20 employees	Medium 20-99 employees	Large 100+ employees	Own 10%	Own 50%	Own 100%
Developing economies								
Botswana	2006	342	215	86	41	157	124	105
Burkina Faso	2006	139	106	27	6	13	11	7
Burundi	2006	270	219	42	9	47	46	41
Kenya	2003	284	79	104	76	54	38	15
Lesotho	2003	75	18	12	30	37	33	26
Madagascar	2005	293	101	115	77	115	98	73
Malawi	2006	160	18	86	53	42	35	24
Emerging Economies								
Argentina	2006	1063	408	391	264	154	120	90
Brazil	2003	1642	295	886	455	88	74	41
Chile	2006	1017	319	438	260	76	52	42
China	2003	2400	351	944	1087	299	172	88
Colombia	2006	1000	524	363	113	30	20	11
Egypt	2004	977	422	367	188	41	25	12
India	2006	4235	2975	789	356	80	39	10
Indonesia	2003	713	8	332	371	118	104	59
Jordan	2006	503	180	198	125	54	38	35
Morocco	2004	850	146	381	323	169	112	90
South Africa	2003	603	58	252	286	115	90	70
Developed Economies								
Germany	2005	1196	754	289	153	111	101	34
Greece	2005	546	404	81	61	56	52	40
Hungary	2005	610	328	190	92	95	75	50
Ireland	2005	501	319	108	74	61	51	46
Spain	2005	606	367	129	110	43	32	23

Source: Author's compilation from the WBES data.

In the next section, the focus is on the definition and measurement of variables. This is very critical as emphasized in the quotation "What is badly defined is likely to be badly measured" (OECD, 2005:12).

4.4.1 Dependent Variables

4.4.1.1 Firm Performance Indicators

The performance of firms is often described by productivity, efficiency and profitability. There are several ways of measuring productivity identified in the literature. The most common method is the use of total factor productivity (Savvides & Zacharadias, 2005). This, according to Piscitello & Rabbiosi (2005) is the best known measure of firm efficiency performance. While TFP is the appropriate measure, some studies have used the firm's turnover per employee or value added per employee as an indicator for productivity due to the problems associated with getting an accurate measure of the capital stock.

Another dependent variable used in the literature is firm growth, which is measured as the estimate in the growth of firm sales in the past three years (Beck, et al., 2005). The WBES involves a question concerning firm sales in the past three years. It is however not feasible to use this variable in our study given the number of non-responses for this question in most of the countries. With this background, we use labour productivity, measured as value added per employee as the dependent variable (firm productivity). This is done with some degree of confidence since this is one of the frequently used measures in the literature (Tomiura, 2007; Zhou, et al., 2002).

4.4.2 Explanatory Variables

After a critical review of the literature (see Chapter 2), we find various determinants of firm productivity. These include, in addition to the traditional factors of production, firm specific factors such as firm size, age and foreign ownership; technological variables such as innovation, use of technology licensed from foreign firms, the business environment; absorptive capacity factors such as research and development expenditures and the education levels; international relations factors such as exports, imports of raw materials, joint ventures with foreign companies and recruitment of foreign workers

(Arrow, et al., 1961). This section is devoted to the consideration of these variables, discussing how they have been conceptualised previously and defining how they are used in this chapter.

4.4.2.1 Traditional factors of production

A typical Cobb-Douglas production function is explained by labour, capital and raw materials. The tendency in some empirical studies is to include material input intensity in the explanatory variables. In our definition of the dependent variable, value added, we subtract the intermediate inputs from total output. Capital stock creates concern in productivity studies, in terms of how it should be measured. This difficulty arises from the fact that firms have a tendency to overstate depreciation and thereby understate the book value of their physical capital for tax purposes. Hale and Long (2006) used the value of fixed assets to measure the capital stock. The value of fixed assets can be given as the purchase value at the beginning of the year or the replacement value at the end of the year. We follow the approach taken by Arnold, et al., (2008) who got around the problem by using the WBES question which asks about the resale value of machinery and equipment if it had to be sold the next day.

We use this resale value as a proxy for the capital stock which we divide by labour to get capital intensity. This variable is important because it explains how technical change is influenced as capital goods incorporate latest knowledge and innovations. We anticipate capital intensity (CAPIN) to be associated with higher firm productivity hence a positive coefficient is expected. Indirectly, the capital stock includes some level of spillover effects based on the capital accumulation contribution of FDI. Labour *(LAB)* is measured by the number of permanent workers employed plus the average number of temporary workers.

4.4.2.2 Foreign firm presence

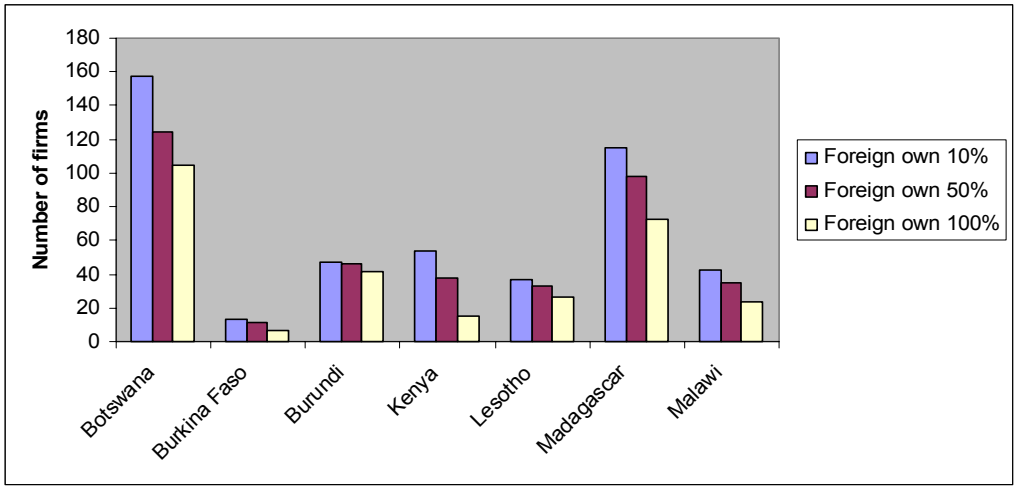
In the WBES, each firm answers a question which enables us to separate domestic firms from international firms and hence determine the nature of ownership. Following the IMF benchmark definition of foreign direct investment (see footnote 1, chapter 1), the cut-off point for a firm to be classified as foreign owned is 10%. Various studies have used different cut-off points 10%, 20%, 25%, and 50% to show the effects of foreign ownership on firm productivity (Arnold & Jarvorcik, 2005; Haskel, et al., 2007; Kee, 2006). The use of a cut off point such as 10 percent can result in the inclusion of portfolio investments. This cut off point of 10% is still considered in this study based on the thinking that "FDI less than the majority share can still influence the performance of the firm to a significant extent" (Vahter & Masso, 2005:16). Another common approach is that adopted by Beck, et al., (2005) who use dummy variables, where the dummy takes on the value of one where any foreign firm or individual has a positive financial stake in the ownership of the firm and zero in the absence of any foreign ownership.

The cut-off approach is more appealing as it leaves room for comparison with other studies that have used either one cut off point and those that have similar cut off levels , thus, in this chapter, we use cut off points of 10%, 20%, 50% and full ownership and observe how the results change. Foreign ownership is in the same class with variables such as openness, import competition, production intended for export which are all indicators of economic integration (Maloney, 2001; Sachs & Warner, 1995). The results for various cut-off points are presented and evaluated based on the sensitivity to the different cut off points that define the ownership variable *(OWN)*. A statistically significant coefficient of *(OWN)* shows that foreign owned firms are more productive than domestic firms.

In Figure 4.1 to Figure 4.3, the foreign ownership at 10%, 50% and 100% levels is shown graphically for developing, emerging and developed economies, respectively. In the case of developing countries, Figure 4.1 shows that for Burkina Faso and Burundi, the differences in the number of firms based on different cut-off points are very small.

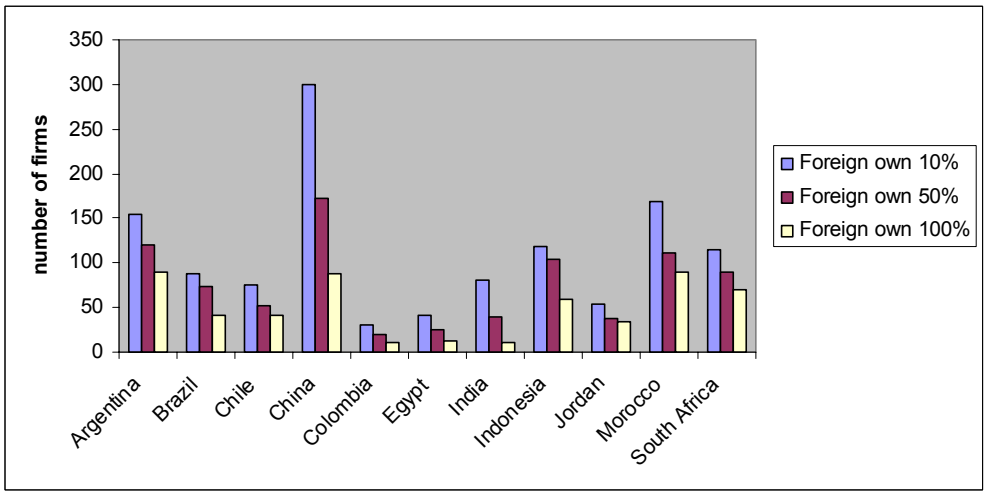
Technology transfer is likely to be limited in countries with a higher degree of foreign ownership such as that displayed for Botswana and Madagascar. Some authors have shown that host country benefits are high in situations where foreign ownership is minimal (Bishop, 2007; Dimelis & Louri, 2004; Haddad & Harrison, 1993). The reason is that with minimal ownership, foreign firms are not concerned about protecting technology and knowledge.

Figure 4. 1: Level of Foreign Ownership in Developing Countries



Source: Author

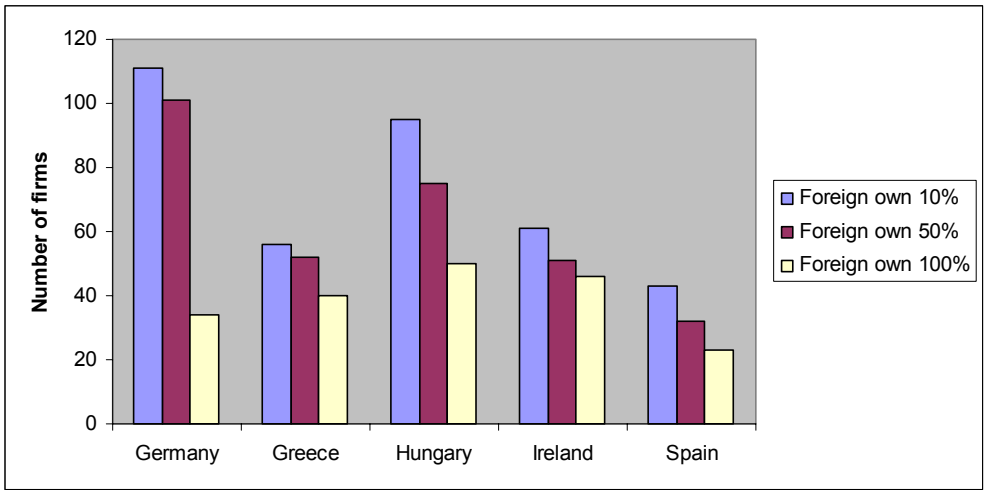
Figure 4. 2: Level of Foreign Ownership in Emerging Economies



Source: Author

Figure 4.2 shows the foreign ownership in emerging economies as defined by different cut-off points. There are significant differences especially in China, Argentina and Morocco. Based on this graph, the use of different cut-off points can be justified. The next figure is that of developed economies.

Figure 4. 3: Foreign Ownership in Developed Economies



Source: Author

In the developed country sample as shown in Figure 4.3, it seems reasonable to assume that there will be significant variations in the impact of FDI based on the cut-off point used in the definition of foreign ownership.

In order to measure the spillover effects, a number of authors have defined foreign presence by using the ratio of foreign firm employment to the total employment in each industry *(SPILEMP)* (Aitken & Harrison, 1999; Blomstrom, et al., 2000; Haskel et al., 2007; Kokko, 1996; Ruane & Ugur, 2004). Another way to proxy for the spillovers is to define foreign presence as a ratio of the foreign firms output to gross output in each industry (SPILPUT). This is the approach that is followed by (Blomstrom & Sjoholm, 1999; Sasidharan & Ramanathan, 2007; Jarvorcik & Spatareanu, 2008). In this study we include the ratio of the foreign firms' exports to gross exports *(SPILEXP)* in order to

capture the spillover effect. Using the variables SPILEMP and SPILPUT, and SPILEXP, we are able to investigate intra-industry spillovers.

4.4.2.3 Technological variables

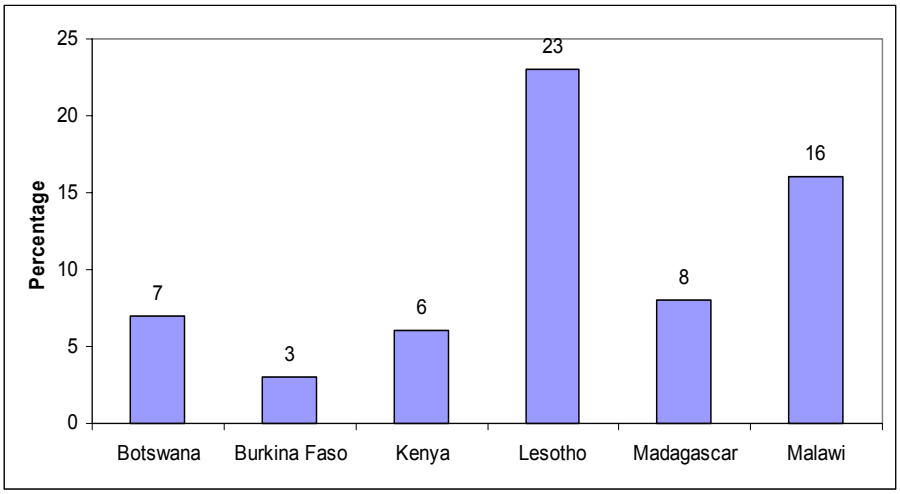
The technological variables that influence firm productivity include: product innovation, process innovation, technology licensed from foreign firms, training of employees and ISO certification (Goedhuys, et al., 2008). Firms involved in innovation are more productive (Crepon, et al., 1998; Kleinknetch & Mohnen, 2002). To capture this aspect, we include a dummy variable of whether or not a firm is involved in innovation *(INNOV)*. Alternatively, we can include a dummy variable for the use of technology licensed from foreign firms (TECLICE), which takes a value of one if the firm licenses technology from foreign company and zero otherwise. The importance of research and development expenditure is glowing in the literature. Firms involved in research and development (R&D) are expected to have higher TFP (Griliches, 1998). The variable (*RAND)* is a dummy variable that takes on a value of one if the firm is involved in research and development and a value of zero otherwise. Barrios, et al., (2002) use the indicator of whether a firm conducts research and development or not as a measure of absorptive capacity. As Cohen and Levinthal (1990) have observed, if a firm engages in R&D activities, this is a sign that they have capacity to absorb new technologies and develop new product and process innovations. Studying the Chilean economy, Benavente (2006) found that firm productivity is not affected by research and development expenditure or product and process innovation. In Table 4.2, the technological variables are briefly defined.

Table 4. 2: Description of Technological Variables

Variable	Definition
PRODINN	Dummy variable taking a value of 1 if new product was introduced into the market (product innovation)
PROCINN	Dummy variable taking a value of one if new production process was developed
RAND	Measured as the expenditure on research and development[11]
ISOCET	Dummy variable equal to one if firm has the international certification (ISO certification)
TECLICE	Dummy variable equal to one if firm used technology licensed from foreign company

In Figures 4.4 and 4.5, we show the distribution of firms using technology licensed from foreign companies. This is done for developing and emerging economies.

Figure 4. 4: Developing Country Firms (%) Using Technology Licensed from Foreign Firms

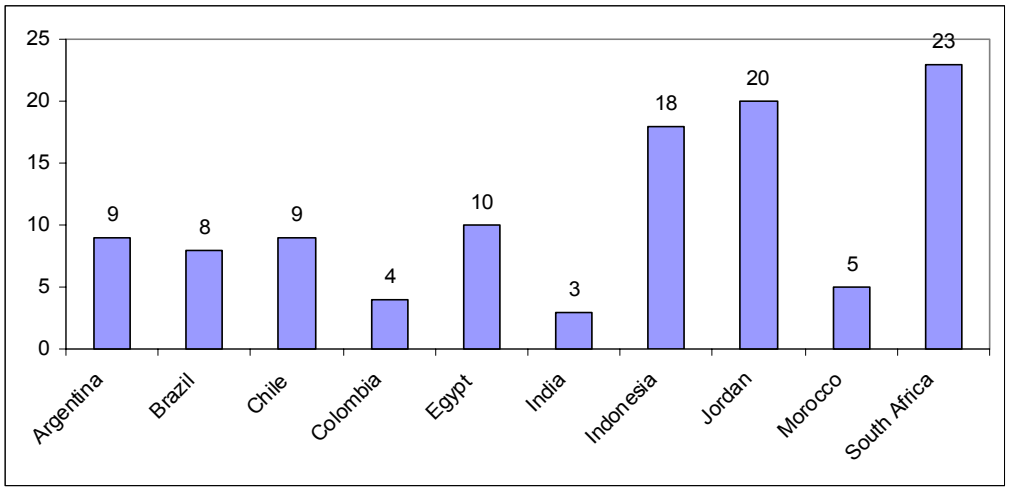


Source: Author

Developing countries, which are characterised by large small and medium sized enterprises can benefit from technology licensed from foreign firms. The use of ideas generated somewhere helps firms to improve products and production processes at a lower cost.

[11] Where the research and development dummy variable is used, the sample size is smaller due to the large number of non-responses.

Figure 4. 5: Emerging Economy Firms (%) Using Technology Licensed from Foreign Firms



In Figure 4.5, from the sample of emerging economy firms, it is evident that South Africa has the highest percentage of firms using technology licensed from foreign firms. In the developed country sample, none of the firms indicated use of technology licensed from foreign companies. Romer (1993) discusses the gap between rich and poor countries, which he describes as the idea gap. He maintains that it is through FDI that technology can be transferred to poor countries. The absence of data on firms using technology licensed from foreign firms does not necessarily mean that developed countries do not use licensed technology. There is a possibility that developed country firms can use technology from other developed countries and yet maintain the leading position in the technological frontier. With this position, when interacting with developing and emerging economies, there exists a potential for spillovers.

4.4.2.4 Firm specific characteristics

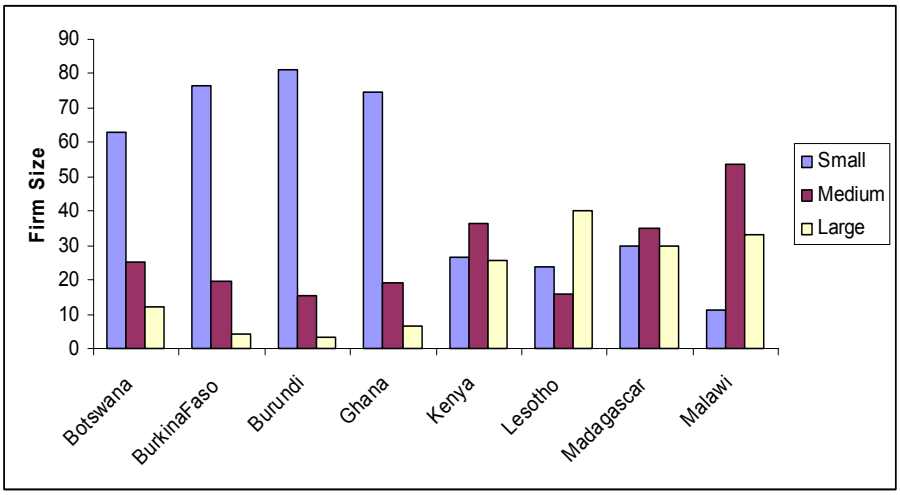
Firm productivity is influenced by firm characteristics such as age, size and ownership. Older firms have older equipment and machinery and therefore have less scope for the learning process. Newer firms on the other hand have new equipment that is likely to be more efficient than the older machinery. With regards to age, firms can be more productive as they become older due to the cumulative learning by doing effect and less productive firms are not likely to survive over longer periods. The relationship between

the productivity of firms and the variable *(AGE)* is thus expected to be either positive or negative. This variable is constructed by subtracting the year the firm started operations from the year the survey was carried out.

Firm size influences productivity differences between domestic and foreign firms as the later exploit economies of scale (Head & Ries, 2003; Piscitello & Rabbiosi, 2005). The standard practice in the literature is to measure firm size by the number of employees[12] *(SIZE)*. The expected sign is ambiguous as studies in the literature show positive and negative outcomes. Larger firms are considered to be more efficient than smaller firms (Jovanovic, 1982; Pakes & Ericson, 1998) and on the other hand firm growth has been found to decrease with firm size and age (Evans, 1987). Estimating firm survivorship, (Lundvall & Battese, 2000) used firm size and firm age as proxies. They defined small firms to be those with 5-20 employees (less than 50 in Aitken and Harrison, (1999)); medium firms: 51-500 employees and large firms: more than 500 employees. In this study, we distinguish between a small firm, medium and large firms based on the number of employees. We adopt the WBES classification, where small firms have less than 10 employees, medium firms 20-100 and large firms more than 100 employees. In our three samples, developing, emerging and developed, the percentage coverage of small, medium and large firms is shown in Figures 4.6, 4.7.and 4.8, respectively. In order to control for firm size in our model, we include dummy variables in the model.

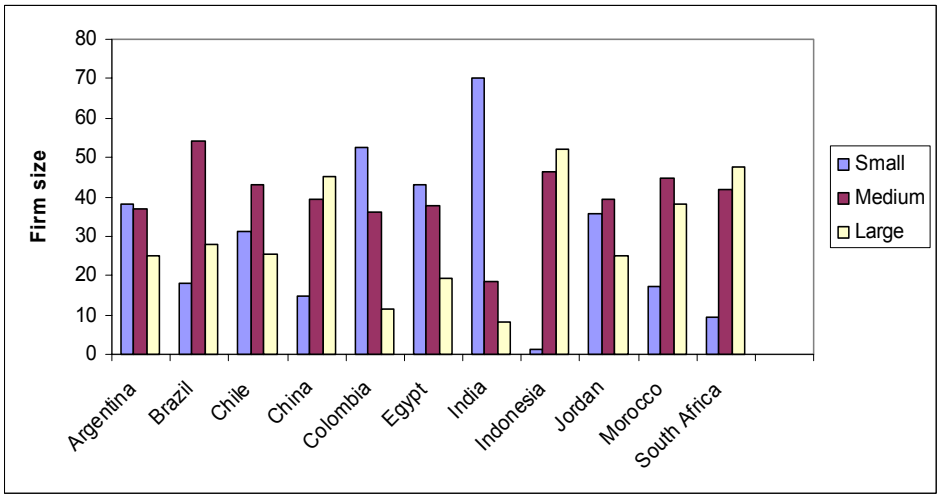
[12] This variable is thus highly correlated to labour; hence where firm size is included in the regression, labour is excluded. There are however studies in which firm size is measured based on the sales of a firm (Blomstrom & Sjoholm, 1999)

Figure 4. 6: Developing Country Sample Breakdown by Firm Size



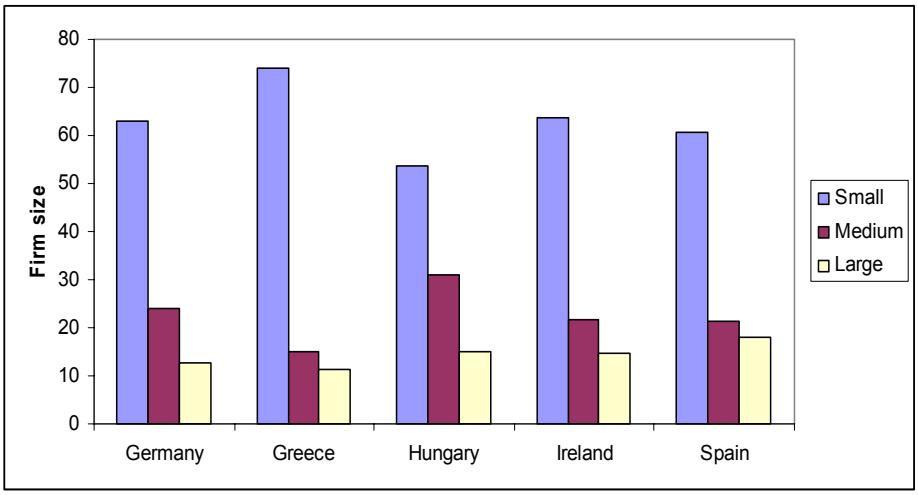
Source: Author

Figure 4. 7: Emerging Economy Sample Breakdown by Firm Size



Source: Author

Figure 4. 8: Developed Country Sample Breakdown by Firm Size



Source: Author

4.4.2.5 Investment climate and institutional factors

Institutional economics identifies institutional factors and the business environment that the firm operates in as important factors that influence the productivity of the firm (Coase, 1998; North, 1991). This aspect encompasses issues such as the legal environment and corruption levels (Dollar et al, 2005; Hallward-Driemeier, 2003). These market imperfections constrain the firms' ability to fund investment projects. The World Development Report (UNCTAD, 2005) focused on how the investment climate can be improved for the benefit of all economies. Such factors are often cited as factors that determine the amount of FDI flowing into a country. In some literature, they have been identified as factors that affect the productivity of firms.

The quality and availability of infrastructure such as transportation, electricity, communications and access to information and computing technologies (ICT) can have large impacts on firm productivity especially in developing countries (Canning, 1999; Canning & Bennathan, 2000; Easterly & Rebelo, 1993). The importance of services in influencing the productivity of firms is investigated by considering telecommunications,

access to finance and the provision of electricity. Looking at the WBES data, we note that there exist subjective and objective measures of these infrastructure variables.

One critical variable that influences firm productivity is access to finance (ACFIN). Caprio et al. (2001) summarise the importance of access to finance. The firm's access to finance can be measured using the principal components analysis. The credit index is derived from three indicators of whether a firm has a bank loan, the number of banks used by the firm and whether the firm has an overdraft facility or line of credit, the share of loans denominated in foreign currency, and the share of inputs the firm buys on credit from its suppliers. In this study, we use the principal components analysis to construct an indicator for access to finance (FINACCESS). Using an index such as the one constructed here has limitations in that one fails to extricate the impact of each indicator included in the index.

4.4.2.6 Human capital

In order for technological spillovers to be realized at the firm level, there are certain enhancing features of the firm and its employees that are complementary. For, instance, the education level of the top manager and the percentage of employees with higher education can influence the firm's productivity. While the variable *(LAB)* is measured by the employment level in the firm, the quality of labour *(EDUC)* within a firm serves as an absorptive capacity measure where highly skilled workers moving from MNCs transfer the knowledge to domestic companies (Acemoglu & Zilibotti, 2001; Aw et al, 2005; Hale & Long, 2006; Tan & Lopez-Acevedo, 2002). Hale and Long (2006) have referred to this effect as a "network externality". This labour mobility channel of spillover transfer has also been explored in theoretical models by a number of authors, among them are Fosfuri et al., 2001; Glass & Saggi, 2002; Haaker, 1999 and Kaufmann, 1997. According to Caves (1996), the diffusion of management practices from Japan to the United States was made possible by the mobility of managers.

The use of the level of education of the firm's top manager as a human capital indicator is linked to the upper echelon theory as discussed by Hambrick and Mason (1984), which links managerial characteristics with MNC performance. Other studies that have considered the impact of educational level on productivity include Gaither (1975); Norburn and Birley (1988).

Still on the issue of knowledge transfer, Gerschenberg (1987), analyzing MNC behaviour in Kenya, indicates that in general MNCs offer more training to their employees than domestic firms. This equips their employees with more skills and allows for demonstration spillovers when the workers leave their job or as the workers interact with the locals. The impact can be huge in a country such as Ireland (the Celtic Tiger), where foreign firms employ almost half of the manufacturing workforce. The variable *TRAIN* is captured as a dummy variable which takes on a value of one if the firm engaged in some form of training for its employees and zero otherwise. The limitation with this cross sectional framework is that while good proxies are found, learning spillovers are not instantaneous. The data is not likely to capture these as it focuses on a single year.

4.4.2.7 International Relations

We expect to find firms trading in international markets to be more productive due to the competition effect. Several studies have shown that exports *(EXP)* are beneficial to firm productivity (Blalock & Gertler, 2004; Fernandes & Isgut, 2005; Kraay, 1999). On the other hand, there are studies that have failed to show an improvement in productivity after a firm began exporting (Bernard & Wagner, 1997; Bernard & Jensen, 1999; Clerides et al., 1998). As firms export, they may obtain information from foreign markets that can be used to enhance the quality of their product and hence increasing their competitive edge. Dummy variables are often used to measure exports, with a value of one for a firm that exports and zero for a firm that does not export. In this chapter we use the logarithm of value of exports as one of the explanatory variables in the production function. The intensity of exports is hypothesized to have a positive impact on firm productivity. This goes for the estimation of productivity differentials. With regards to

the measurement of spillovers, we follow Aitken, et al., (1997) who define a variable which is measured as the share of exports of foreign firms in the industry's total exports. In this study we call this variable *SPILPORT* and we use it to determine if the export activities of multinational firms generate positive externalities on the domestic firms. This is an important variable that allows us to test the Bhagwati (1994) hypothesis at the firm level[13]. In this case, firms that have export promoting strategies would have more spillovers to domestic firms. As Lall and Streeten (1977) have shown, MNCs tend to be more export oriented than domestic firms. The nature of spillovers in this case would be through an increase in the capacity of domestic firms to export as confirmed in the study by Aitken et al. (1997) and Sousa et al. (2000).

4.4.2.8 Industry and country dummy variables

In addition to the traditional explanatory variables discussed in this section, there is need to control for the industry in which the firm belongs. The reason is that the number of firms in each industry varies across the sample. Hence in some cases, spillovers may be affected by the type of industry (vertical spillovers). According to Dunning and Rugman (1985) multinational corporations may be attracted to more productive and profitable industries. For this reason, we need to control for industrial sectors *(IND)*. Tables A2, A3 and A4 in the appendix show the industrial classification of firms in each of the groups of countries under study. In the second strand of our empirical investigation where the countries in the developing, emerging and developed country samples are merged, we control for the country differences using country dummy variables.

4.5 Estimation and results

When using cross sectional data, it is imperative that statistical diagnostic tests are carried out. This is a critical initial step to follow as previous studies on productivity spillovers have been criticized for their failure to undertake such tests (Blomstrom & Sjoholm,

[13] Bagwati (1994) hypothesizes that FDI is more beneficial to countries following export promotion strategies than to countries following an import substituting strategy.

1999; Dimelis & Louri, 2004). We run a battery of specification tests such as the variance inflation factor (VIF) test for multicollinearity, the Ramsey's regression specification error (RESET) test for functional form and the White test for heteroscedasticity.

Before the Ordinary Least Squares regression, we check the pair wise correlation of explanatory variables to detect multicollinearity (Folster & Henrekson, 2001). The correlation matrices for developing, emerging and developed economies are shown in the Appendix, Tables A5, A6 and A7, respectively. The correlation coefficients between explanatory variables are relatively low (less than 0.7), suggesting that there is no serious multicollinearity (Fox, 1991; Mason & Perreault, 1991). The three proxies for foreign presence, SPILPUT, SPILEMP and SPILEXP are highly correlated. This shows that FDI measures are consistent when measured in terms of output, employment and export levels.

4.5.1 Productivity differences between domestic and foreign firms

In this section value added per worker for all firms is regressed on capital and labour plus other key determinants of productivity, of which the variable of interest is firm ownership (Piscitello & Rabbiosi, 2005). We estimate a model with minimal firm controls plus the ownership variable. Entering explanatory variables successively helps to clearly show the impact of the variable concerned. Furthermore, for developing, emerging and developed economies, we estimate an equation with all explanatory variables together for the three samples of developing, emerging and developed economies. The explanatory variables are likely to be significant when included alone because of a larger sample size. When all variables are included, omitted variables problems are eliminated although at the cost of multicollinearity. This kind of analysis helps as a robustness check as we are able to tell if the significance changes depending on the type of variable included in the regression. We confirm productivity differentials between seven developing countries, eight emerging economies and five developed economies. The developing country results are presented in the Appendix in Table A.8.

In Table A.8 we control for the influence of technological variables, ISO certification (ISOCERT), process innovation (PROCIN) and use of technology licensed from foreign firms (TECLICE). Using ISOCERT, we find that productivity differences occur at all levels less than full foreign ownership. The ISOCERT variable itself is highly significant and useful in explaining firm productivity. This shows the importance of ISO certification as an explanatory variable for firm productivity. TECLICE has a positive impact and in this case productivity differences are encountered at all levels of foreign ownership. Process innovation, however, turns out to be an insignificant variable in this analysis. This could be explained by the inadequate capacity of developing countries to embark on successful process innovation and the greater tendency to rely on technology licensed from foreign firms. The variable TECLICE is highly significant and when controlling for this variable, productivity differences are confirmed at all levels of foreign ownership.

In Table A.9, the importance of international integration on firm productivity in developing countries is shown. As is the case with technological variables analysed in Table A.8, productivity differences are encountered at all levels of foreign ownership which are less than full ownership. When controlling for joint ventures, then statistically significant productivity differences are found at levels of ownership below 50%.

The same pattern described above emerges when controlling for finance and infrastructure (Table A.10). Access to finance turns out to be an insignificant factor in determining firm productivity in developing countries. This could be explained by poorly developed financial markets in developing economies. The same analysis is maintained when we control for transport infrastructure. We still note that productivity differences exist between domestic and foreign firms depending on the level of foreign ownership. Specifically in this case productivity differences exist between foreign and domestic firms for less than 100% ownership. At full ownership, while the coefficient is negative, it is statistically insignificant (see column VIII, Table A.10). The importance of electricity in this specification is not confirmed as the coefficient is statistically

insignificant. With regards to productivity differences between foreign and host firms, the result obtained when controlling for access to finance and transport is maintained. From this analysis, one could infer that for positive spillovers to be experienced in developing economies there is need for less than 100% ownership, but for some kind of joint operations between domestic and foreign firms. This interaction between domestic and foreign firms at less than full ownership is confirmed by Barrios et al., (2002). They maintain that fully owned firms are more independent and secluded from domestic firms. Hence while Ramachandran (1993) maintains that foreign investors have a tendency to transfer technology to their wholly owned subsidiaries than to partially owned subsidiaries, the lack of interaction with the former would prevent spillovers. Whether this view holds or not is established in Section 4.5.2 where the actual spillovers to domestic firms are estimated.

In Table A.11, we control for ICT and telecommunication. ICT is proxied by the use of email; whether or not a firm has a website and the extent to which telecommunication infrastructure is an obstacle. In this case we find significant productivity differences between domestic and foreign firms, the effects decline as the level of foreign ownership increases. At 100% ownership, there are no productivity differences that are statistically significant at the 1%, 5% and 10% levels of significance. The results reinforce the importance of ICT as an explanatory variable in firm productivity studies.

Training employees is an important factor in defining productivity differences between foreign and domestic firms as shown in Table A.12. The training variable is significant at the 1% level and productivity differences are established across the different levels of foreign ownership. The differences get smaller with the level of ownership. Another important human capital indicator is the educational level of the "top manager" (EDUC). Controlling for this variable, we note significant productivity differentials between domestic and foreign firms at less than full foreign ownership. The top manager's education level becomes statistically significant at the higher levels of foreign ownership. This could be related to the chance that foreign owned firms have more educated top managers.

We proceed to investigate what happens when all the variables are entered in the regression equation. The results are reported in Table 4.3. Productivity differences between foreign and domestic firms are confirmed in the case of ownership defined by equity levels of 10%, 20% and 50%. The influence of the level of foreign equity in productivity is generally constant for these three cutoff points. Interestingly, in the case of fully foreign owned firms, the productivity differences that arise due to the presence of foreign firms disappear (see column IV in Table 4.3). With some degree of productivity differences confirmed, it will be of interest to examine the spillover effects on domestic firms (refer to section 4.5.2).

Table 4. 3: Developing Country Results: Controlling for all Explanatory Variables

Dependent variable is labour productivity	I	II	III	IV
CONSTANT	6.9801***	6.9801***	6.9655***	7.0016***
	(0.4549)	(0.4549)	(0.4604)	(0.4652)
CAPIN	0.1909***	0.1909***	0.1920***	0.1921***
	(0.0343)	(0.0343)	(0.0347)	(0.0351)
LAB	-0.2058***	-0.2058***	-0.1866**	-0.1558**
	(0.0741)	(0.0742)	(0.0747)	(0.0748)
Firm age	0.0025	0.0025	0.0023	0.0023
	(0.0043)	(0.0043)	(0.0044)	(0.0044)
OWN (10%)	0.5405***			
	(0.1672)			
OWN (20%)		0.5405***		
		(0.1672)		
OWN (50%)			0.4017**	
			(0.1782)	
OWN (100%)				0.1029
				(0.1942)
TECHNOLOGY	0.4665**	0.4665**	0.4776**	0.5518**
	(0.2317)	(0.2317)	(0.2349)	(0.2355)
EMAIL	0.6015***	0.6015***	0.6159***	0.6093***
	(0.1679)	(0.1679)	(0.1698)	(0.1715)
TRAIN	0.1816	0.1816	0.2007	0.2054
	(0.1576)	(0.1576)	(0.1592)	(0.1611)
FINACCESS	-0.0050	-0.0050	-0.0053	-0.0053
	(0.0040)	(0.0040)	(0.0041)	(0.0041)
INFRASTRUCTURE	0.1029	0.1029	0.1025	0.1232
	(0.1684)	(0.1684)	(0.1782)	(0.1720)
Industry dummies	Yes	Yes	Yes	Yes
Country dummies	Yes	Yes	Yes	Yes
Adjusted R2	0.7791	0.7848	0.7904	0.7694
Number of observations	251	251	251	251

Notes: * indicates significance at the 10% level. ** indicates significance at the 5% level***indicates significance at the 1% level. All regressions include a constant term and six industry dummies, and the dependent variable is the productivity of labour.

In Tables A.13 – A.17 in the Appendix, we present results from the emerging economy analysis. Focusing on the effects of technology shown in Table A13, we find that contrary to the developing country findings, productivity differentials are found at all levels of foreign ownership. The similarity is that PROCIN is also insignificant in the case of emerging economies. When we control for research and development (RAND), productivity differentials are only experienced when the cut-off point for foreign ownership is 100%. This confirms the notion that foreign owned firms engage in relatively higher research and development activities.

When we control for international integration (Table A.14), in the emerging economy context, productivity differences occur at all levels of foreign ownership. TECLICE is highly significant and this is in line with the pattern where emerging economies use a relatively higher volume of technology licensed from foreign firms compared to developing countries (refer to Figures 4.4 and 4.5). Exports and joint ownership however enter insignificantly. While productivity differences are evident at all levels of foreign ownership, we note that financial access, transport and electricity are highly insignificant. ICT and training variables are significant. In Table 4.4, we include all the variables in an emerging economy regression.

Table 4. 4: Emerging Economy Productivity Differences

Dependent variable is labour productivity	I	II	III	VI
CONSTANT	2.7669***	2.7620***	2.7591***	2.7314***
	(0.2100)	(0.2099)	(0.2098)	(0.2094)
CAPIN	0.3373***	0.3376***	0.3382***	0.3394***
	(0.0229)	(0.0228)	(0.0228)	(0.0227)
LAB	-0.2578***	-0.2577***	-0.2574***	-0.2586***
	(0.0403)	(0.0403)	(0.0402)	(0.0402)
Firm age	-0.0042*	-0.0042*	-0.0042*	-0.0042*
	(0.0024)	(0.0024)	(0.0024)	(0.0024)
OWN (10%)	0.1979			
	(0.1330)			
OWN2 (20%)		0.1953		
		(0.1348)		
OWN (50%)			0.2091	
			(0.1468)	
OWN (100%)				0.3144
				(0.1709)
TECHNOLOGY	0.0492	0.0492	0.0518	0.0616
	(0.1163)	(0.1164)	(0.1161)	(0.1141)
EMAIL	0.2736***	0.2743***	0.2744***	0.2761***
	(0.1035)	(0.1035)	(0.1035)	(0.1034)
TRAIN	0.1543	0.1554	0.1564	0.1601
	(0.1098)	(0.1098)	(0.1098)	(0.1097)
FINACCESS	0.0022	0.0023	0.0023	0.0023
	(0.0023)	(0.0023)	(0.0023)	(0.0023)
INFRASTRUCTURE	-0.0372	-0.0380	-0.0363	-0.0386
	(0.1192)	(0.1192)	(0.1192)	(0.1192)
Industry dummies	Yes	Yes	Yes	Yes
Country dummies	Yes	Yes	Yes	Yes
Adjusted R2	0.8916	0.8915	0.8915	0.8917
Number of observations	1088	1088	1088	1088

As shown in Table 4.4, the coefficients on the ownership variables are positive but insignificant. Unlike in the developing country case, we cannot confirm that foreign firms are more productive than domestic firms with some reasonable level of confidence. One possible explanation could be that firms in emerging markets are highly competitive. Hence there are no significant differences between their productivity and that of foreign firms (which are likely to be developed country firms). An interesting observation for this group is the fact that changing the definition of FDI by defining four cut off points does not change the results significantly (Models I-IV yield minor differences in the coefficients of the ownership variable). With this absence of confirmed productivity

differentials, it will be interesting to investigate if there are any spillovers to domestic firms caused by the presence of foreign firms. This analysis is carried out in Section 4.5.2.

Next we turn to the developed country sample. Similar models to those in Tables A.8 to A.17 are used so as to allow comparison between the three country groupings. The slight change in the model is that for developed countries, the selected technological variable is process innovation instead of technology licensed from foreign firms. This is because none of the developed country firms reported that they used technology licensed from foreign firms. The technological variable used captures the same effect and is deemed more important as we expect developed countries to be more involved in process innovation.

When entering each of the identified explanatory variables, we find for developed economies that there are no productivity differences across all ownership levels. Variables which turn out to be statistically significant include education, business association, access to finance, email usage and website access. Additionally, there are two interesting findings from these results. Firstly, the training variable which was highly significant in the developing and emerging economy samples turns out to be insignificant in the developed country sample. Secondly, financial access, which turned out to be insignificant in developing and emerging economies is highly important for developed country firms. With regards to the training variable, this outcome could be influenced by the highly qualified employees in developed country firms, who may actually not be in need of additional formal training.

Table 4. 5: Productivity Differences in Developed Economies

Dependent variable	I	II	III	VI
CONSTANT	2.7917***	2.7902***	2.7867***	2.7867***
	(0.2459)	(0.2459)	(0.2464)	(0.2462)
CAPIN	0.2502***	0.2498***	0.2495***	0.2497***
	(0.0174)	(0.0174)	(0.0174)	(0.0174)
LAB	-0.170***	-0.168***	-0.167***	-0.167***
	(0.0229)	(0.0228)	(0.0227)	(0.0224)
Firm age	0.0038***	0.0038***	0.0038***	0.0038***
	(0.0014)	(0.0014)	(0.0014)	(0.0014)
OWN (10%)	0.0457			
	(0.0780)			
OWN (20%)		0.0226		
		(0.0788)		
OWN (50%)			-0.0009	
			(0.0805)	
OWN (100%)				0.0177
				(0.1200)
TECHNOLOGY	0.0996**	0.1000**	0.1004**	0.1007**
	(0.0509)	(0.0509)	(0.0509)	(0.0509)
EMAIL	0.0985*	0.0989*	0.0993*	0.0991*
	(0.0555)	(0.0555)	(0.0555)	(0.0555)
TRAIN	0.0308	0.0304	0.0302	0.0301
	(0.0540)	(0.0540)	(0.0540)	(0.0540)
FINACCESS	0.0042***	0.0042***	0.0041***	0.0042***
	(0.0016)	(0.0016)	(0.0016)	(0.0016)
INFRASTRUCTURE	-0.0396	-0.0395	-0.0391	-0.0385
	(0.1467)	(0.1468)	(0.1468)	(0.1468)
Industry dummies	Yes	Yes	Yes	Yes
Country dummies	Yes	Yes	Yes	Yes
Adjusted R2	0.2809	0.2807	0.2806	0.2807
Number of observations	910	910	910	910

Notes: * indicates significance at the 10% level. ** indicates significance at the 5% level *** indicates significance at the 1% level.All regressions include a constant term and six industry dummies

We note again the absence of statistically significant productivity differences in Table 4.5. In terms of the definition of FDI, it is observed again here that the results are not affected much by changing the cut-off point. One cannot therefore use the differences in the measurement of FDI as an explanation of the myriad of results in the literature. Studying Canadian firms, Globerman, et al., (1994) found evidence of greater productivity of foreign firms than domestic firms after controlling for industry effects. For the USA, Doms and Jensen (1998) found higher total factor productivity for foreign firms and for Belgium, DeBacker and Sleuwaegen (2002) find that foreign firms are more

productive than domestic firms. While these countries are not part of our sample, they are discussed here as they represent empirical evidence from developed countries as indicated in the literature.

In the next section, we explore the presence of spillovers (in the absence of significant productivity differences). There are some reasons why foreign firms may generally fail to perform effectively. These include the time lags of assembling and assimilating new plants, acquiring bad firms which they cannot improve, some learning costs and management problems (Li and Gusinger, 1991; Harris and Robinson, 2001). As such, the failure to find significant productivity differences cannot be used as evidence of the absence of spillovers.

4.5.2 Productivity spillovers from foreign firm presence

In order to capture the spillovers caused by foreign firm presence on domestic firms, regressions are run for domestic firms only. The presence of foreign firms is captured by three spillover variables, SPILPUT, SPILEMP and SPILPORT. The results are presented in Tables 4.6, 4.7 and 4.8. It should be noted that although we found minor differences across the FDI definitions in section 4.5.1, in this section, estimations were once again carried out for productivity differences across equity ownership levels. The results are robust to changes in FDI cut offs, hence we report in this section only results of the benchmark definition of FDI (foreign ownership of 10% or more).

Table 4. 6: Developing Economy Spillovers from Foreign Presence

Labour productivity	I	II	III
CONSTANT	4.6540***	4.6718***	4.8763
	0.5703	0.5562	0.5664
CAPIN	0.1724***	0.1729***	0.1806***
	(0.0372)	(0.0372)	(0.0391)
LAB	-0.1563*	-0.1604*	-0.1901
	(0.0880)	(0.0884)	(0.0944)
AGE	0.0067	0.0068	0.0066
	(0.0051)	(0.0051)	(0.0054)
TECHNOLOGY	0.7293***	0.7346***	0.7382
	(0.2609)	(0.2608)	(0.2676)
ICT	0.6501***	0.6510***	0.6249
	(0.1931)	(0.1930)	(0.2092)
TRAIN	0.1726	0.1740	0.1834
	(0.1798)	(0.1797)	(0.1932)
FINACCESS	-0.0092**	-0.0092**	-0.0097
	(0.0046)	(0.0046)	(0.0049)
INFRASTRUCTURE	0.0529	0.0579	-0.0090
	(0.1851)	(0.1853)	(0.2044)
SPILLOVER	0.0122	0.0134	0.0096
	(0.0149)	(0.0152)	(0.0145)
COUNTRY DUMMY	Yes	Yes	Yes
Number of observations	193	193	173
Adjusted R2	0.7724	0.7904	0.7641

Note: The spillover variables in regressions I, II and III are, SPILPUT, SPILLEMP and SPILPORT, respectively.

For developing economies, we do not find statistically significant productivity spillovers. The coefficients on spillover variables are positive and statistically insignificant.

Table 4. 7: Emerging Economy Spillover Effects

Labour productivity	I	II	III
CONSTANT	2.8454***	2.8130***	2.8171
	(0.2294)	(0.2392)	(0.2363)
CAPIN	0.3215***	0.3182***	0.3188***
	(0.0238)	(0.0238)	(0.0238)
LAB	-0.2015***	-0.2011***	-0.2012***
	(0.0431)	(0.0432)	(0.0432)
AGE	-0.0044*	-0.0046*	-0.2012
	(0.0026)	(0.0026)	(0.0432)
TECNOLOGY	0.0014	0.0014	0.0021
	(0.1230)	(0.1232)	(0.1232)
ICT	0.2102**	0.2181**	0.2168
	(0.1068)	(0.1068)	(0.1069)
TRAIN	0.1310	0.1346	0.1334
	(0.1158)	(0.1160)	(0.1159)
FINACCESS	0.0031	0.0030	0.0030
	(0.0024)	(0.0024)	(0.0024)
INFRASTRUCTURE	-0.0687	-0.0552	-0.0574
	(0.1268)	(0.1266)	(0.1268)
SPILLOVER	-0.0114	-0.0052	-0.0101
	(0.0076)	(0.0123)	(0.0188)
COUNTRY DUMMY	Yes	Yes	Yes
Number of observations	980	980	980
Adjusted R2	0.8406	0.8866	0.8866

Note: The spillover variables in regressions I, II and III are, SPILPUT, SPILLEMP and SPILPORT, respectively.

In the emerging economy sample, the coefficients for spillover variables are negative and statistically insignificant (see Table 4.7). The result of negative spillovers is surprising and could be explained by the illustration given by Aitken and Harrison (1999), where negative spillovers occur due to foreign firm presence in an imperfect competition market with fixed costs of production and hence downward sloping average cost curves. Studying the Indonesian economy, Blomstrom and Sjoholm (1999) find that labour productivity and spillovers are not affected by the degree of foreign ownership. In our study, we have confirmed that the degree of ownership does not affect productivity differences and the extent of spillovers. For the Moroccan manufacturing firms, no spillovers were found (Haddad and Harrison, 1993).

Table 4. 8: Developed Economy Spillover Effects

Labour productivity	I	II	III
CONSTANT	2.9363***	2.9484***	2.8437***
	(0.2456)	(0.2456)	(0.2521)
CAPIN	0.2545***	0.2556***	0.2630***
	(0.0178)	(0.0178)	(0.0184)
LAB	-0.1800***	-0.1810***	-0.1843***
	(0.0226)	(0.0226)	(0.0230)
AGE	0.0037***	0.0036***	0.0035***
	(0.0014)	(0.0014)	(0.0014)
TECHNOLOGY	0.1050**	0.1051**	0.1046**
	(0.0514)	(0.0513)	(0.0519)
ICT	0.0887	0.0941	0.1285
	(0.0562)	(0.0560)	(0.0579)
TRAIN	-0.0094	-0.0104	0.0040
	(0.0549)	(0.0548)	(0.0566)
FINACCESS	0.0056***	0.0056***	0.0054***
	(0.0016)	(0.0016)	(0.0017)
INFRASTRUCTURE	-0.0450	-0.0540	-0.0648
	(0.1441)	(0.1440)	(0.1457)
SPILLOVER	0.0176***	0.0155***	0.0162***
	(0.0060)	(0.0049)	(0.0075)
COUNTRY DUMMY	Yes	Yes	Yes
Number of observations	852	852	806
Adjusted R2	0.2850	0.2867	0.2919

Note: The spillover variables in regressions I, II and III are, SPILPUT, SPILLEMP and SPILPORT, respectively.

Table 4.8 shows the spillover effects in developed countries. It is evident in this case that the spillover effects are positive and of high statistical significance (1% level of significance). While the results presented in Table 4.8 show spillovers with the bare minimum level of foreign ownership (10% cut-off), further results (not reported in Table 4.8) show that the size of the spillover increases with the level of ownership. At the full level of foreign ownership, sizes of the spillover are 0.3264, 0.2801 for SPILPUT and SPILEMP, respectively. This gives weight to the observation by Blomstrom and Kokko (1998) that even when foreign firms prefer wholly owned production facilities, FDI can still benefit the host country. These results change when we consider SPILEXP as the proxy for spillovers. In this case, while spillovers increase up to 50% foreign ownership level, at the full ownership level, SPILPORT is negative and statistically insignificant. Studying the Greece economy, Barrios, et al., (2002) find insignificant spillovers. His

explanation is that this could be due to the inclusion of large firms in the sample. He maintains that small firms respond better to spillovers than large firms. In this study, this is clearly not the case as Figure 4.8 shows that smaller firms were over sampled compared to medium and large firms in all developed country samples and hence according to Barrios et al. (2002)'s argument we would expect positive spillovers. One study that found positive spillovers in Australia and negative in Canada is that of Caves (1974). Besides this empirical evidence being very old, the study was based on 23 observations. Our case is that of very recent data and the number of observation is 568 in the case of developed countries. Our results show superior performance of MNCs in developed economies.

4.5 Conclusion

This chapter uses the World Bank Enterprise Survey (WBES) data for developing, emerging and developed economies to investigate the impact of foreign ownership (FDI) on the productivity of firms. Due to the diversity of countries included in the analysis, the chapter is very informative. A number of traditional explanatory variables used in the literature are included in the analysis. Productivity differences between foreign and domestic firms are observed in developing countries but not in emerging and developed countries. The spillover effects are positive in developing and developed economies but negative across emerging economies. However, only those of developed economies are of statistical significance.

While the use of cross sectional data has been criticized over missing variables, measurement error, misspecification error and selection bias, we conclude that with these limitations, one can still glean very informative initial insights from the data such as the findings in this chapter. These would then be developed further as efforts to collect panel datasets on the countries studied here by the WBES are ongoing. As more effort is put in by the World Bank and other institutions to carry out more establishment surveys, it is anticipated that the availability of panel data will enable a more informed study. The time dimension would allow us to carry out a dynamic analysis of firm productivity and improve the current results. The use of panel data would solve the problem of

endogeneity that arises due to the fact that our variable of interest, foreign ownership is affected by firm productivity. This problem can be solved by the use of relevant time lag structures in the analysis, a technique that cannot be performed in a clear-cut manner using cross sectional data.

Comparing our findings to previous studies, we conclude that our research is complementary, in the sense of providing new evidence that groups similar countries, including some that have not been studied before. Since the learning process is ongoing and literature builds up, our study does not present definitive solutions. For such definitive outcomes, further research needs to be carried out. With this in mind, our results present an opportunity for policy initiatives. The absence of significant spillovers in developing and emerging economies suggests that the reason for incentives given to foreign firms is not justified. As Oman (2000) points out, there is a risk of overbidding, wherein the subsidies granted may exceed the spillover benefits, if any. Policy efforts must be directed towards increasing the skills of firms and their size instead of just blindly liberalizing FDI with the expectation of high technology spillovers. An interesting area for further study is that of market distortions that result from subsidies and the welfare implications of such. In addition, we realize that each of the explanatory variables informing this study is part of a major literature and hence a good point for further structures.

CHAPTER 5: LONG RUN RELATIONSHIP BETWEEN FDI AND GROWTH: TIME SERIES EVIDENCE

5.1 Introduction

In this chapter we investigate the causal relationship between FDI and growth for individual countries that make up the time series, cross-sectional sample. There has been an increasing debate over the use of panel data analysis as opposed to time series. According to Chowdhury and Mavrotas (2005), it is important to study the FDI growth relationship for individual countries because the relationship is country-specific. We infer the causal relationship between FDI and growth using the Toda-Yamamoto (T-Y) test – a modified version of the common Granger causality test (Toda & Yamamoto, 1995). It is important to undertake causality tests in this study because as Li and Liu (2005) point out, the relationship between FDI and growth has been increasingly endogenous since the 1980's. It is therefore crucial that as we investigate the FDI-growth relationship, we consider the possible endogeneity of variables.

The Toda Yamamoto test comes in as a solution to the traditional Granger causality test which requires stationarity of variables. In cases of non-stationary variables, one has to take the first difference of variables in the regressions. This causes problems where the impact is caused by level variables rather than change variables. The T-Y test fits a Vector Autoregression Model (VAR) model in levels of the variables and not in first differences. This is advantageous in that we can investigate long run information, which is often ignored in systems which require first differencing and pre-whitening (Clarke & Mirza, 2006).

The T-Y test is further developed by Rambaldi and Doran (1996) and Zapata and Rambaldi (1997). According to Zapata and Rambaldi (1997), the main advantage of using the T–Y test is that it is not necessary to pretest the variables for their integration and cointegration properties before carrying out the Toda Yamamoto test. While this may

tempt some researchers to skip the unit root testing, Toda and Yamamoto (1995) maintain that their test does not substitute the conventional unit root tests. The two are considered to be complements to each other.

In the T-Y framework, we estimate an augmented Vector Autoregression model (VAR) of order k, VAR (k) in levels. This is augmented by the maximum order of integration (d_{max}), so that we estimate a VAR (k+ d_{max}) model. The (k+dmax)th order VAR which focuses on the relationship between growth and FDI is specified as follows:

Growth, Equation

$$Y_t = \alpha_0 + \sum_{i=1}^{k} \beta_{1i} Y_{t-i} + \sum_{j=k+1}^{d\max} \beta_{2j} Y_{t-j} + \sum_{i=1}^{k} \lambda_{1i} FDI_{t-i} + \sum_{j=k+1}^{d\max} \lambda_{2j} FDI_{t-j} + \varepsilon_{1t}, \qquad (5.1)$$

FDI, Equation

$$FDI_t = \tilde{\alpha}_0 + \sum_{i=1}^{k} \tilde{\beta}_{1i} Y_{t-i} + \sum_{j=k+1}^{d\max} \tilde{\beta}_{2j} Y_{t-j} + \sum_{i=1}^{k} \tilde{\lambda}_{1i} FDI_{t-i} + \sum_{j=k+1}^{d\max} \tilde{\lambda}_{2j} FDI_{t-j} + \varepsilon_{2t}, \qquad (5.2)$$

where Y is log of per capita GDP and FDI is the ratio of FDI to GDP. If there is unidirectional causality from FDI to growth then $\lambda_{1i} \neq 0 \forall i$ in equation 5.1 and we can conclude that FDI Granger causes growth. If on the other hand causality runs from growth to FDI, then $\tilde{\beta}_{1i} \neq 0 \forall i$ in equation 5.2.

Three outcomes are expected from this specification:

i. Unidirectional causality from either FDI to GDP or GDP to FDI
ii. Bidirectional Granger causality which would signify feedback between FDI and GDP, implying that they are complements of each other and
iii. The absence of causality between FDI and GDP.

The rest of the chapter is structured as follows; section 5.2 presents the data summary using descriptive statistics. This is followed by section 5.3 that focuses on unit root

testing to enable us determine d_{max}. In section 5.4 we determine the optimal lag length (k) using various information criteria. At this stage we then estimate the VAR (k+ d_{max}) and present the causality findings. Section 5.5 provides concluding remarks.

5.2 Data Summary

In this section we focus on two main variables, FDI and real per capita GDP. We compare the average FDI and per capita GDP in the different country groupings as well as the correlation coefficients. These are useful as preliminary insights into how the data are related.

The descriptive statistics show that there is considerable cross-country variation as reflected by the mean per capita GDP and the mean FDI together with their standard deviations (Table 5.1). The countries with highest FDI to GDP ratio in the developing, emerging and developed economies are Lesotho, Chile and Belgium, respectively. Those with the highest mean per capita GDP are Botswana, Argentina and Japan, respectively. Countries with the highest FDI to GDP ratio do not necessarily have the highest per capita GDP ratio. From the primary correlation between FDI and per capita GDP, out of nine developing countries, five have a negative sign, out of 13 emerging economies, two have a negative sign and all the 16 developed high income OECD economies show positive correlation. These correlations are important in so far as they suggest some relationship between the two variables, either negative or positive. It is however important to note that correlation does not necessarily imply causation. Economic growth and FDI may well be driven by a third factor such as human capital. In addition, we cannot conclude based on the correlation coefficients because the positive or negative correlation may be driven by reverse causality. We seek to address this issue using the T-Y test.

Table 5. 1: FDI and GDP Growth (Country time series, 1975-2005)

Country	Average FDI	Standard deviation	Average per capita GDP	Standard deviation	Correlation coefficient
		Low Income Economies			
Botswana	2.8334	4.5710	2425.443	1113.496	-0.1155
Burkina Faso	0.2605	0.2524	191.7010	30.5263	0.4662
Burundi	0.1633	0.3464	129.8899	19.1407	-0.0209
Ghana	1.1214	1.2234	228.8973	27.4256	0.5388
Kenya	0.4217	0.3937	418.8033	16.3387	-0.1742
Lesotho	7.6880	9.9792	376.4532	85.6120	0.6425
Madagascar	0.5204	0.8696	268.0606	43.6325	-0.3745
Malawi	0.6240	0.8806	144.5300	10.4553	0.0964
Zambia	3.0375	2.3412	386.7251	69.6515	-0.5407
		Middle income economies			
Argentina	1.6349	1.6193	7065.024	699.2840	0.4724
Brazil	1.4705	1.3628	3487.540	265.7822	0.4591
Chile	3.4979	2.7577	3565.917	1286.930	0.8131
China	2.3778	1.9242	577.7923	421.4684	0.5757
Colombia	1.9182	1.6061	1841.680	250.4264	0.7126
Egypt	2.5053	2.0098	1185.699	294.5365	0.1175
India	0.3647	0.4669	347.3957	116.8833	0.9103
Indonesia	0.7231	1.3166	631.0759	214.9431	-0.0333
Jordan	2.7399	4.8148	1789.501	248.1240	0.3870
Morocco	0.8044	1.1337	1202.168	188.6089	0.6559
South Africa	0.5044	1.2615	3197.766	188.7795	-0.2069
Thailand	1.9867	1.6517	1499.043	639.3544	0.7457
		Developed Countries			
Australia	1.673328	1.634769	17404.24	3238.187	0.19444
Austria	0.919763	1.077174	19681.34	3717.398	0.637625
Belgium	9.51344	18.67591	18728.33	3294.395	0.478756
Canada	1.894117	1.802109	19755.43	3183.857	0.456624
Denmark	2.061194	4.515658	24726.13	4409.885	0.394662
Finland	1.496590	2.248738	19243.59	3961.195	0.597236
France	1.419212	1.152266	18977.47	3003.528	0.878774
Germany	0.847208	1.994308	19189.36	3407.850	0.386791
Greece	2.061194	4.515658	24726.13	4409.885	0.394662
Ireland	3.728293	8.000300	16344.68	7351.927	0.341337
Italy	0.512861	0.476306	15987.66	2821.275	0.637878
Japan	0.054329	0.085529	31104.99	6169.241	0.339940
Spain	1.947021	1.444869	11445.29	2526.477	0.712472
Sweden	2.820297	4.554655	23114.73	3729.245	0.525962
United Kingdom	2.661921	2.116146	19979.26	4082.125	0.658889
United States	0.935778	0.753259	28349.79	5302.122	0.624733

In section 5.3, we perform the Toda-Yamamoto test for the long run relationship between FDI and growth. The aim is to determine the direction of causality between FDI and economic growth as measured by per capita GDP growth.

5.3 Single Equation Time series unit root tests

> *"The immense literature and diversity of unit root tests can at times be confusing even to the specialist and presents a truly daunting prospect to the uninitiated"(Phillips & Xiao, 1998:423)*

In this section we carry out unit root tests for the data as a build up process to Toda Yamamoto causality estimation. In addition to the need for establishing the maximum order of integration, it is well known that if data are not pretested, findings may suffer from the problem of spurious regression if the data is non-stationary (Granger & Newbold, 1974). Furthermore unit root tests have become a critical starting point in empirical macroeconomic research as Nelson and Plosser (1982) argued that almost all macroeconomic time series have unit root.

There is a large pool of literature on unit root testing which presents diverse unit root tests. In order to test unit roots in macroeconomic time series of the countries under study, we examine literature on unit root theory, looking carefully for recent developments in the theory. The commonly used methods to test for unit root tests are the Dickey Fuller (1979) (DF) and Augmented Dickey Fuller (1981) (ADF) tests (Bernard et al., 2000). These tests require that the error structure be individually independent and identically distributed (iid). Thus, the focus is on investigating whether the time series data have transitory or permanent shocks. The difference between the DF and ADF tests is that the ADF test caters for autocorrelation in residuals if it is present. The ADF critical values at 1%, 5% and 10% levels are -3.96; -3.41 and -3.12, respectively. These critical values differ, depending on the specification of the function; with a constant, trend or trend and constant.

A unit root test superior to the ADF is the Phillips- Perron (1988) (PP) test. It is superior in that the test statistics in the PP test have been adjusted to cater for serial correlation by using the Newey and West (1997) covariance matrix. The null hypothesis of this test is that the variable has unit root. There is a trade-off between the size and power of unit root

tests (Blough, 1992). They must have either a high probability of falsely rejecting the null of non-stationarity when the Data Generating Process (DGP) is a nearly stationary process, or low power against a stationary alternative. The reason for this is that some unit root processes display behaviour closer to stationary white noise than to a non-stationary random walk, while some trend stationary processes behave more like random walks (Harris, 1995).

Tables 5.2, 5.3 and 5.4 present the stationarity results for the set of developing countries, emerging economies and developed countries, respectively. We have used the Augmented Dickey Fuller (Dickey & Fuller, 1981) and the Phillips-Perron (1988) tests. We determined the lag structure using the Akaike Information Criterion (AIC). The major steps in the Toda Yamamoto test include the determination of the maximum order of integration of the variables to be tested. This is done because the standard asymptotic theory holds if extra lags of the variables equal in number to the maximum order of integration are added. As shown in Tables 5.2, 5.3 and 5.4, the maximal order of integration is 1 for some countries and 2 for others. An extra lag and two extra lags respectively are therefore added to the VAR that we estimate for each country.

Table 5. 2: Developing Country Unit Root Tests (1975-2006)

Country	Variable	ADF	Phillips Peron test	Diagnosis
Botswana	Log GDP per capita	-4.851532	-5.359481	I(2)
	FDI	-7.119951 I	-12.79469 I	I(1)
Burkina Faso	Log GDP per capita	-6.420330	-6.512737	I(1)
	FDI	-4.848870	-4.848152	I(0)
Burundi	Log GDP per capita	-4.505412	-4.494423	I(1)
	FDI	-5.430524	-5.429738	I(0)
Ghana	Log GDP per capita	-3.365812	-3.858448	I(1)
	FDI	-7.024422	-8.975244	I(1)
Kenya	Log GDP per capita	-4.544793	-3.136221	I(0)
	FDI	-7.937801	-11.00232	I(1)
Lesotho	Log GDP per capita	-6.071752	-3.041054	I(0)/I(1)
	FDI	-4.911628	`-4.905884	I(1)/I(0)
Madagascar	Log GDP per capita	-6.437969	-6.361271	I(1)
	FDI	-5.376279	-2.537589	I(1)
Malawi	Log GDP per capita	-6.431003	-6.515176	I(1)
	FDI	-4.660569	-4.922467	I(0)
Zambia	Log GDP per Capita	-6.155249	-4.455182	I(1)
	FDI	-4.250734	-4.489159	I(0)

*Reject the null hypothesis of unit root at the 10% level.

** Reject the null hypothesis of unit root at the 5% level.

*** Reject the null hypothesis of unit root at the 1% level

Table 5. 3: Emerging Economy Unit Root Test Results (1975-2006)

Country	Variable	Augmented Dickey-Fuller	Phillips Peron Test	Diagnosis
Argentina	Log GDP per capita	-4.360880	-4.220213	I(1)
	FDI	-7.058551	-12.98822	I(1)
Brazil	Log GDP per capita	-4.115633	-5.771912	I(1)
	FDI	-4.036160	-4.036160	I(1)
Chile	Log GDP per capita	-3.566131	-3.463614	I(1)
	FDI	-7.962096	-11.77004	I(1)
China	Log GDP per capita	-5.750961	-7.666591	I(0)
	FDI	-5.922065	-10.54104	I(2)
Colombia	Log GDP per capita	-3.503216	-3.520726	I(1)
	FDI	-6.798803	-12.48290	I(1)
Egypt	Log GDP per capita	-4.594676	-4.714349	I(1)
	FDI	-5.160660	-5164417	I(1)
India	Log GDP per capita	-4.972530	-4.978413	I(1)
	FDI	-5.888355	-5.047379	I(1)/I(2)
Indonesia	Log GDP per capita	-4.025070	-4.025070	I(1)
	FDI	-4.327513	-4.316380	I(1)
Jordan	Log GDP per capita	-4.741063	-4.897947	I(1)
	FDI	-4.874051	-5.423240	I(1)
Morocco	Log GDP per capita	-10.18018	-9.949316	I(1)
	FDI	-6.554672	-9.320134	I(1)
South Africa	Log GDP per capita	-6.562140	-10.63594	I(2)
	FDI	-6.142357	-4.720770	I(0)
Thailand	Log GDP per capita	-5.709196	-7.989374	I(2)
	FDI	-6.121231	-9.400729	I(1)

*Reject the null hypothesis of unit root at the 10% level.

** Reject the null hypothesis of unit root at the 5% level.

*** Reject the null hypothesis of unit root at the 1% level

NB* the null hypothesis under the KPSS test is that of stationarity.

Table 5. 4: Developed Country Stationarity Test Results (1975-2006)

Country	Variable	Augmented Dickey-Fuller Test	Phillips Peron Test	Diagnosis
Australia	Log GDP per capita	-4.683663	-4.746711	I(1)
	FDI	-8.208059	-8.208059	I(0)
Austria	Log GDP per capita	-6.027465	-6.086572	I(1)
	FDI	-5.274769	-5.344323	I(0)
Belgium	Log GDP per capita	-6.326587	-6.644120	I(1)
	FDI	-5.971884	-7.399231	I(2)
Canada	Log GDP per capita	-6.625594	-2.684223	I(2)/I(1)
	FDI	-6.176474	-7.912555	I(1)
Denmark	Log GDP per capita	-4.911090	-4.910732	I(1)
	FDI	-7.820766	-6.389530	I(1)
Finland	Log GDP per capita	-4.211616	-4.993055	I(2)
	FDI	-11.82259	-11.90932	I(1)
France	Log GDP per capita	-4.434643	-7.317204	I(2)
	FDI	-6.685232	-6.039106	I(2)/I(1)
Germany	Log GDP per capita	-5.679268	-9.527331	I(2)
	FDI	-4.516595	-.516595	I(0)
Greece	Log GDP per capita	-4.743833	-4.737090	I(1)
	FDI	-7.820766	-6.243710	I(1)
Ireland	Log GDP per capita	-7.504520	-7.360457	I(2)
	FDI	-5.809628	-5.610814	I(1)
Italy	Log GDP per capita	-4.000174	-4.779826	I(1)
	FDI		-5.203679	I(1)
Japan	Log GDP per capita	-6.311717	-6.965438	I(2)
	FDI	-5.162967	-5.183328	I(1)
Spain	Log GDP per capita	-5.721559	-5.723445	I(2)
	FDI	-4.361973	-7.272666	I(1)
Sweden	Log GDP per capita	-6.297626	-8.690866	I(2)
	FDI	-6.893468	-10.87175	I(1)
United Kingdom	Log GDP per capita	-4.610827	-8.092535	I(2)
	FDI	-5.499115	-6.095597	I(1)
United States	Log GDP per capita	-7.164015	-12.64122	I(2)
	FDI	-3.984830	-4.14207	I(1)

We have successfully determined the order of integration for each of the series. The results are presented in Tables 5.2, 5.3 and 5.4. In all the three tables above it can be seen that the series examined are either I(0), I(1) or I(2) depending on the test procedure. The evidence indicates that $d_{max} = 1$ for all developing countries except Botswana. $d_{max} = 2$ for Botswana, China, India and all developed economies except for Australia, Austria, Denmark, Greece and Italy . We proceed to determine the optimal lag length in section 5.4.

5.4 The optimal lag length and causality test results

The next step is to determine the optimal lag length for the system of equations to be estimated. As a starting point, we selected an initial lag length of k=4. The optimal lag lengths as determined by the various criteria are presented in Table 5.5. According to Khim and Liew (2004), the Akaike Information Criterion (AIC) and Final Prediction Error (FPE) are the appropriate criteria for smaller samples with 60 observations or less. In the same vein, Chowdhury and Mavrotas (2003) use the Akaike Final Prediction Error to determine the optimal lag length. We proceed to estimate a VAR with optimal lag length plus one or two extra lags depending on the maximal order of integration established in Section 5.3 and then use the Wald test for the significance of the lagged coefficients, excluding the extra lag(s). For the per capita GDP equation, if we reject the null hypothesis that the coefficients are jointly equal to zero, then we can conclude that FDI granger causes GDP. For the FDI equation, if we reject the null that the coefficients are jointly equal to zero, then GDP granger causes FDI.

Table 5. 5: Optimal Lag Lengths for the Toda Yamamoto Test

Country	LR	FPE	AIC	SC	HQ
Developing –African Countries					
Botswana	1	2	2	1	2
Burkina Faso	1	1	1	1	1
Burundi	1	1	1	1	1
Ghana	2	2	2	2	2
Kenya	2	3	3	2	3
Lesotho	1	1	1	1	1
Madagascar	4	1	1	1	1
Malawi	1	1	1	1	1
Zambia	1	1	3	1	1
Emerging Economies					
Argentina	1	1	1	1	1
Brazil	1	1	4	1	1
Chile	1	1	1	1	1
China	1	3	3	1	3
Colombia	1	3	3	1	3
Egypt	1	1	1	1	1
India	1	1	1	1	1
Indonesia	4	4	4	4	4
Jordan	1	3	3	1	1
Morocco	2	2	2	2	2
South Africa	1	2	4	1	2
Thailand	2	2	2	2	2
Developed countries					
Australia	1	1	1	1	1
Austria	1	1	1	1	1
Belgium	1	1	2	1	1
Canada	1	1	1	1	1
Denmark	1	1	1	1	1
Finland	2	3	3	2	3
France	2	2	2	2	2
Germany	1	1	1	1	1
Greece	1	1	1	1	1
Iceland	1	1	1	1	1
Ireland	2	2	2	1	2
Israel	1	4	4	1	1
Italy	1	1	1	1	1
Japan	1	2	2	1	1
Netherlands	2	2	2	2	2
New Zealand	1	1	1	1	1
Norway	1	3	4	1	3
Portugal	2	2	3	2	2
Spain	2	4	4	2	3

Sweden	1	1	1	1	1
United Kingdom	3	3	3	2	3
United States	1	2	2	1	2

Notes: LR= Likelihood Ratio; FPE = Final Prediction Error; AIC = Akaike Information Criterion; SC = Schwarz criterion; and HQ = Hannan Quinn Criterion

The lag lengths are applied to equations 5.1 and 5.2 as outlined in Section 5.1 so as to estimate a system of two equations. We use the Seemingly Unrelated Regression (SUR) technique and test the coefficient estimates using the modified Wald test (MWald). The causality results are summarised in Tables 5.6, 5.7 and 5.8.

Table 5. 6: Toda-Yamamoto Test for FDI and GDP Growth in Developing Countries

Country	FDI Granger causes GDP growth	GDP Granger causes FDI	Direction of causality
Botswana	2.278519 [0.3201]	1.189824 [0.5516]	FDI≠>GDP GDP≠>FDI
Burkina Faso	0.154005 [0.6947]	2.261252 [0.1326]	FDI≠>GDP GDP≠>FDI
Burundi	0.009467 [0.9225]	0.095847 [0.7569]	FDI≠>GDP GDP≠>FDI
Ghana	0.553484 [0.7583]	3.089484 [0.2134]	FDI≠>GDP GDP≠>FDI
Kenya	8.950977 [0.0299]**	7.549867 [0.0563]*	FDI→GDP GDP→FDI
Lesotho	1.658554 [0.1978]	0.607731 [0.4356]	FDI≠>GDP GDP≠>FDI
Madagascar	0.801040 [0.3708]	0.188906 [0.6638]	FDI≠>GDP GDP≠>FDI
Malawi	1.681875 [0.1947]	0.573999 [0.4487]	FDI≠>GDP GDP≠>FDI
Zambia	3.494553 [0.0616]*	0.115610 [0.7338]	FDI→GDP GDP≠>FDI

Notes: Modified Wald chi-square statistics is used to test whether k-lags are equal to zero are reported with p-values in parentheses. The reported estimates are asymptotic Wald statistics. ≠> denotes statistical insignificance and hence fails to reject the null hypothesis of non-causality. → Denotes the rejection of the null hypothesis of non-causality.

Table 5. 7: Toda-Yamamoto Test for FDI and Growth in Emerging Economies

Country	FDI → GDP growth	GDP growth → FDI	Direction of causality
Argentina	3.409607 [0.0648]*	3.832698 [0.0503]*	FDI→GDP GDP→FDI
Brazil	0.003988 [0.9496]	0.036091 [0.8493]	FDI≠>GDP GDP≠>FDI
Chile	0.407119 [0.5234]	0.768404 [0.3807]	FDI≠>GDP GDP≠>FDI
China	1.331199 [0.7217]	10.56883 [0.0143]**	FDI≠>GDP GDP→FDI
Colombia	18.4688 [0.0004]***	2.047920 [0.5625]	FDI→GDP GDP≠>FDI
Egypt	6.660986 [0.0099]**	0.698807 [0.4032]	FDI→GDP GDP≠>FDI
India	0.428042 [0.5130]	1.916960 [0.1662]	FDI≠>GDP GDP≠>FDI
Indonesia	4.715835 [0.3177]	21.9347 [0.0002]***	FDI≠>GDP GDP→FDI
Jordan	2.162330 [0.5394]	0.694006 [0.8746]	FDI≠>GDP GDP≠>FDI
Morocco	0.58900 [0.7449]	3.31101 [0.1910]	FDI≠>GDP GDP≠>FDI
South Africa	0.159360 [0.9234]	0.233953 [0.8896]	FDI≠>GDP GDP≠>FDI
Thailand	7.871791 [0.0195]**	12.56126 [0.0019]**	FDI→GDP GDP→FDI

Notes: Modified Wald chi-square statistics is used to test whether k-lags are equal to zero are reported with p-values in parentheses. The reported estimates are asymptotic Wald statistics. ≠> denotes statistical insignificance and hence fails to reject the null hypothesis of non-causality. → denotes the rejection of the null hypothesis of non-causality.

Table 5. 8: Toda-Yamamoto Causality Test for FDI and Growth in Developed Economies

Country	FDI → GDP growth	GDP growth → FDI	Direction of causality
Australia	0.007537 [0.9308]	0.1785 [0.6726]	FDI≠>GDP GDP≠>FDI
Austria	0.033322 [0.8552]	2.11363 [0.1460]	FDI≠>GDP GDP≠>FDI
Belgium	0.118969 [0.7302]	0.005303 [0.9420]	FDI≠>GDP GDP≠>FDI
Canada	0.194735 [0.6590]	1.803394 [0.1793]	FDI≠>GDP GDP≠>FDI
Denmark	0.071863 [0.7886]	0.046891 [0.8286]	FDI≠>GDP GDP≠>FDI
Finland	1.999534 [0.5725]	5.894393 [0.1169]	FDI≠>GDP GDP≠>FDI
France	0.296205 [0.8623]	18.835 [0.0001]***	FDI≠>GDP GDP→FDI
Germany	0.050746 [0.8218]	0.055021 [0.8145]	FDI≠>GDP GDP≠>FDI
Greece	0.071863 [0.7886]	0.046891 [0.8286]	FDI≠>GDP GDP≠>FDI
Ireland	0.434370 [0.8048]	3.429139 [0.1800]	FDI≠>GDP GDP≠>FDI
Italy	0.130094 [0.7183]	0.250495 [0.6167]	FDI≠>GDP GDP≠>FDI
Japan	1.88886 [0.3889]	4.639084 [0.0983]*	FDI≠>GDP GDP→FDI
Spain	1.853680 [0.7626]	10.28852 [0.0358]*	FDI≠>GDP GDP→FDI
Sweden	1.335853 [0.2478]	0.777303 [0.3780]	FDI≠>GDP GDP≠>FDI
United Kingdom	1.548979 [0.6710]	6.526403 [0.0886]*	FDI≠>GDP GDP→FDI
United States	3.233166 [0.1986]	0.783844 [0.6758]	FDI≠>GDP GDP≠>FDI

Notes: Modified Wald chi-square statistics is used to test whether k-lags are equal to zero are reported with p-values in parentheses. The reported estimates are asymptotic Wald statistics. ≠> denotes statistical insignificance and hence fails to reject the null hypothesis of non-causality. → denotes the rejection of the null hypothesis of non-causality.

The results show diverse causality results with unidirectional, bidirectional and no causality confirmed. These have implications for growth and FDI policy. Unidirectional causality from FDI to GDP exists in Zambia, Colombia and Egypt. This suggests that in these countries FDI serves as an engine for economic growth. It follows then that for these three countries, incentives given to attract FDI growth can be justified as important for economic growth.

Unidirectional causality from GDP to FDI exists in China, Indonesia, France, Japan, Spain and the United Kingdom. The implication is that higher levels of economic activity lead to increased FDI inflows (the market size hypothesis). For these countries, FDI incentives may be reduced with no harm to economic growth. Bidirectional causality between FDI and growth exists in Kenya, Argentina and Thailand. The implication is that GDP and FDI influence each other. In this case, a high level of GDP would result in a high level of FDI and vice versa. For these countries, we conclude that FDI and GDP are endogenous variables. There is no causality relationship identified in Madagascar, Malawi, Brazil, Ghana, Chile, India, Jordan, Morocco, South Africa, and in all developed economies except France, Japan, Spain and the United Kingdom. For these countries where no causal relationship is identified, the implication is that FDI and growth are not related.

It is also important that we undertake a comparison of our results with those of other studies. However, it remains critical that one takes note of the differences in model specifications, estimation procedures, data sets and data frequencies. Our more recent dataset helps us to substantiate previous results and as the empirical evidence shows, in some cases different results surface. When we compare our findings to the work of Chowdhury and Mavrotas (2006), there is a sharp contrast for Chile, where the authors found causality to be running from GDP to FDI as opposed to the no causality at all that we have established. The difference may be explained by the different methodologies as well as the selected period of study. In the same study, bi-directional causality was established for Thailand, which is indeed confirmed in our results.

In another study by Frimpong and Oteng-Abayie (2006), causality running from FDI to GDP was found for Ghana in the post ESAP period. The same study found that there is no evidence of a causal relationship between FDI and GDP in the pre-ESAP and in the entire period. This second piece of evidence is in harmony with our findings which show absence of causality in the case of Ghana.

For the developed countries, a study by Ericsson and Irandoust (2001) which focused on the period 1970-1997 found bi-directional causality for Sweden and no causality at all for Denmark and Finland. Our results are consistent with the findings for Denmark and Finland but differ on Sweden where we found no causality effects. Ericsson and Irandoust (2001) conclude that the differences across nations could be explained by substantial differences in the nature and dynamics of FDI. We adopt this thinking and use the differences in GDP per capita and FDI inflows shown in Table 5.1 as evidence of such heterogeneity.

5.5 Conclusion

This chapter is designed to determine the causal relationship between FDI and Growth. We use the Toda-Yamamoto Granger causality framework to establish the direction of causality. There are three major results emerging from the empirical analysis: (i) unidirectional causality from FDI to GDP in Colombia, Egypt and Zambia; (ii) growth induced FDI in China and Indonesia and no causality effects in Brazil, Chile, India, Jordan, Madagascar, Malawi, Morocco, South Africa, and all but four developed countries. The results are consistent with findings from other studies which have generally found lack of evidence of FDI led economic growth (de Mello, 1999, Chowdhury and Mavrotas, 2003). The lack of evidence of growth enhancing FDI could possibly be due to the bivariate framework used and the lack of degrees of freedom in the time series framework. This motivates further analysis of the same data set within a panel data framework in which various channels of the FDI-growth nexus can be explored. Furthermore, the explanatory variables identified in the literature review chapter are included in the next analysis in Chapter 6.

CHAPTER 6: THE IMPACT OF FDI ON ECONOMIC GROWTH: DYNAMIC PANEL DATA EVIDENCE

6.1 Introduction

In this chapter we use dynamic panel data procedures to analyse data for 37 countries which are also split into three sub-samples, developing (comprising nine countries), emerging (with 12 countries) and developed economies (made up of 16 countries). Our aim is to estimate the contribution of FDI to the steady state rate of growth of output and hence provide new estimates of the impact of FDI on long term economic growth. The pooling of countries allows us to get generalised results for these country groupings, where we take advantage of both cross-sectional and time series information. We use both annual (1975 – 2006) and five year averaged data in the analysis. Our data set is unbalanced, with some countries having more observations than others, hence the use of methods such as the least squares dummy variable model (LSDV) and both the difference and system Generalised Method of Moments (GMM). The use of both dynamic and static methods of analysis helps in checking the robustness of the results to the estimation method. The results presented in this chapter are useful in the derivation of policy implications as presented in Chapter 7.

The rest of the chapter is structured as follows: in section 6.2 we use descriptive statistics to summarise the key variables in the panel. The impact of FDI on economic growth is investigated in section 6.3 where we estimate the growth model using panel data for the years 1975 – 2006. Section 6.4 is devoted to the analysis of results from five year averaged data. As the results are presented, we highlight areas where results here corroborate findings in the literature. Section 6.5 concludes and provides a summary of the findings.

6.2 Descriptive Statistics for the annual Panel Data

6.2.1 Summary Statistics

In this section, summary statistics for the 37 countries are presented according to developing, emerging and developed country groupings. Table 6.1 shows the summary statistics of the dependent variable, per capita GDP and the explanatory variables using annual data.

Table 6. 1: Summary Statistics for the Entire Sample and the Three Groupings

Variable	Obs	Mean	Std. Dev.	Min	Max
		37 countries grouped together			
Per capita GDP	1184	9375.926	10083.14	100.49	39824.08
FDI	1167	1.8929	4.5698	-15.13	92.6734
Openness	1175	0.5738	0.3767	0.0023	1.87
Findev1	1131	56.35259	42.81431	-72.99	234.18
Findev2	1164	57.0095	44.2335	1.5423	231.0819
Inflation	1129	28.9416	179.576	-9.6162	3079.81
Exchange rate	1184	240.455	929.176	2.95e-12	10260.85
		Developing countries			
GDP	288	507.8338	779.1192	100.4859	4423.061
FDI	284	1.8198	4.3123	-10.7820	30.82841
Openness	288	0.7144	0.4330	0.0027	1.6704
Findev1	250	21.4658	1.0409	17.5046	22.9924
Findev2	287	13.9153	7.4097	1.5423	34.8406
Inflation	268	19.0376	23.8330	-9.6166	183.312
Exchange rate	288	293.8386	720.335	0.0001	4778.875
		Emerging Economies			
GDP	384	2199.217	1885.971	141	8692.57
FDI	377	1.6773	2.2753	-2.76	22.83
Openness	380	0.502	0.3396	0.06	1.68
Findev1	372	75.0433	38.4714	8.2	234.18
Findev2	368	52.7455	31.8018	8.66	165.72
Inflation	366	67.6994	311.276	-7.63	3079.81
Exchange rate	384	402.0956	1452.048	0.0003	10260.85
		Developed countries			
GDP	512	19746.76	6447.72	8430	39824.08
FDI	506	2.0946	5.8192	-15.1346	92.6735
Openness	507	0.5477	0.3475	0.1057	1.8691
Findev1	509	109.653	64.212	27.396	442.623
Findev2	509	84.391	43.638	18.422	231.082
Inflation	495	5.646	5.121	-0.895	24.875
Exchange rate	512	89.197	287.855	0.4303	1009.439

Notes: Findev1 is the domestic credit provided by the banking sector
Findev2 is the domestic credit to the private sector

As can be seen in Table 6.1, for the group that includes all countries in the sample, the average of net FDI is 1.89 percent of GDP, with a standard deviation of 4.6. The minimum FDI as a percentage of GDP is -15.13 (Ireland in 2005) and the maximum reaches 92.67 (Belgium in 2000). Concerning per capita GDP, we observe that the average rate for all countries in the sample is 9375.93, with a standard deviation of 10083.14. The minimum is 100.49 (Burundi in 2005) and the maximum reaches 39824.08 (Japan in 2006). Grouping all the 37 countries together can be criticised based on this heterogeneity, not only in per capita GDP but in explanatory variables as well. Due to this problem, results from the study based on pooled data have to be generalised with caution. We take advantage of the large dataset to compare the performance of the model to the case where similar and smaller groups of countries are analysed.

6.2.2 Pair wise correlations

Pair wise correlations are important in so far as they enable us to detect if there is a reasonable degree of independent variation amongst the variables. Tables 6.2 to 6.5 show the pair wise correlations for the four groups of countries.

Table 6. 2. Pairwise Correlation for 37 Countries

	GDP	FDI	Open	Inflation	Ex-rate	Findev1	Findev2
GDP	1						
FDI	0.208	1					
OPEN	0.107	0.475	1				
Inflation	-0.401	-0.145	-0.209	1			
Ex-rate	-0.149	-0.095	0.024	-0.270	1		
Findev1	0.012	-0.061	0.005	0.076	-0.028	1	
Findev2	0.7342	0.107	0.079	-0.486	-0.041	-0.058	1

Table 6. 3: Pairwise Correlation for Developing Countries

	GDP	FDI	Open	Inflation	Ex-rate	Findev1	Findev2	Findev3
GDP	1.00							
FDI	0.470	1.00						
OPEN	0.404	0.569	1.00					
Inflation	-0.099	0.120	0.165	1.00				
Ex-rate	-0.2105	-0.210	-0.395	-0.326	1.00			
Findev1	0.214	0.124	0.128	0.064	-0.076	1.00		
Findev2	0.235	-0.062	0.033	-0.310	0.293	0.125	1.00	
Findev3	0.410	0.268	0.249	-0.133	-0.127	0.153	0.570	1.00

Notes: Findev3 is the money and quasi money (M2) as a percentage of GDP.

Table 6. 4: Pairwise correlation for Emerging Economies

	GDP	FDI	Open	Inflation	Ex-rate	Findev1	Findev2	Findev3
GDP	1.00							
FDI	0.3702	1.00						
OPEN	-0.152	0.292	1.00					
Inflation	0.255	-0.169	-0.556	1.00				
Ex-rate	-0.13	0.115	0.07	-0.01	1.00			
Findev1	0.229	0.237	0.322	-0.209	-0.343	1.00		
Findev2	0.106	0.251	0.437	0.251	-0.136	0.814	1.00	
Findev3	-0.163	0.239	0.621	-0.606	-0.337	0.813	0.644	1.00

Notes: Findev3 is the money and quasi money (M2) as a percentage of GDP.

Table 6. 5: Pairwise Correlation for Developed Economies

	GDP	FDI	Open	Inflation	Ex-rate	Findev1	Findev2
GDP	1.000						
FDI	0.044	1.000					
OPEN	0.082	0.552	1				
Inflation	-0.647	-0.228	-0.351	1			
Ex-rate	-0.222	-0.369	-0.266	0.200	1		
Findev1	0.658	-0.115	-0.201	-0.458	0.123	1	
Findev2	0.673	-0.067	-0.123	-0.480	-0.126	0.903	1

Looking at Tables 6.2 to 6.5, positive correlation between FDI and growth is evident: 0.21, 0.47, 0.37 and 0.04 for the entire sample, developing, emerging and developed economies, respectively. Three indicators of financial development are available in the WDI data[14]. These are domestic credit provided by the banking sector (Findev1), domestic credit to the private sector (Findev2) and money and quasi money (M2) as a

[14]For developed economies, there is no data for money and quasi money (M2) in the WDI (2007) data source, thus we rely on domestic credit provided by the banking sector and domestic credit to the private sector.

percentage of GDP (Findev3). For these three indicators, high and positive pair wise correlations are observed. Thus inclusion of all the three indicators in one regression equation is likely to cause serious multicollinearity. To avoid this problem, we enter the variables in succession. We also consider the correlation between the three financial development indicators to be a basis upon which to justify the combination of the three indicators into one index using the principal component (PC) method as discussed in Chapter 3, Section 3.6. Applying the PC method, we identify the common variance of the three indicators and get the general financial development indices presented in equations 6.1 to 6.4 for the entire sample, developing countries, emerging economies and developed countries, respectively. In the square brackets below each equation, we have shown how the new index correlates with our dependent variable (per capita GDP). These indices are entered in the regression and their performance is compared to that of Findev1, Findev2 and Findev3 which are entered in succession.

$$FINDEV_{INDEX1} = 0.707FINDEV1 + 0.707FINDEV2 \quad (6.1)$$

[0.57]

$$FINDEV_{INDEX2} = 0.2386FINDEV1 + 0.704FINDEV2 + 0.6689FINDEV3, \quad (6.2)$$

[0.21]

$$FINDEV_{INDEX3} = 0.606FINDEV1 + 0.6023FINDEV2 + 0.5194FINDEV3 \quad (6.3)$$

[0.09]

$$FINDEV_{INDEX4} = 0.707FINDEV1 + 0.707FINDEV2 \quad (6.4)$$

[0.68]

There is also evidence of positive correlations between openness, inflation and the exchange rate. As motivated in chapter three, these three variables are taken together in this study to be an indicator of the stability of the macroeconomic environment

(MACRO). We innovate by using the constructed MACRO index as yet another indicator of absorptive capacity in our FDI model. We hypothesize in this case that FDI without a favourable macroeconomic environment is not beneficial to economic growth. Since the MACRO indicator contains three of our explanatory variables, namely inflation, exchange rate and openness, where the MACRO indicator is used in the regression, we exclude these three variables. The MACRO indices are shown in equations 6.5 to 6.8 for the full sample, developing economies, emerging economies and developed economies, respectively.

$$MACRO_1 = 0.6786OPEN + 0.2708EXRATE - 0.6828INFCPI \quad (6.5)$$

[-0.19]

$$MACRO_2 = 0.6786OPEN - 0.728EXRATE + 0.0976INFCPI \quad (6.6)$$

[0.12]

$$MACRO_3 = 0.673OPEN + 0.423EXRATE - 0.607INFCPI \quad (6.7)$$

[-0.004]

$$MACRO_4 = -0.686OPEN + 0.100INFCPI + 0.721EXRATE \quad (6.8)$$

[-0.38]

6.3 Estimation using annual data

In Chapter 3, a detailed discussion on the issue of averaging data is presented in Section 3.2.4. It suffices to mention here that there is still wide application of time-series cross sectional analysis where the data is taken as annual (Baltagi, et al., 2007). Those who support annual data maintain that averaging reduces the number of observations and results in loss of potentially useful information. In this section we capture full time series variation in economic growth as well as the cross-sectional variation.

6.3.1 Regression results from the entire sample (37 countries)

6.3.1.1 The fixed effects (static) model

The fixed effects model is found to be a more appropriate estimation technique in the absence of dynamics for this data set. We start by estimating a random effects model, and then test for the significance of random effects using the Breusch and Pagan Lagrange Multiplier Test. To choose between the random effects model and the fixed effects model, Hausman Test is used. This test evaluates if the coefficients between the random effects model and the fixed effects model are different. The test results lead us to a rejection of the null hypothesis of random effects. Thus we settle for the fixed effects model where the results shown in Table 6.6 are obtained.

Table 6. 6: Fixed Effects Results for the 37 Countries, annual data

	I	II	III	IV
Constant	8.9307***	7.7035***	8.5417***	8.0268***
	(0.1145)	(0.0635)	(0.0222)	(0.1875)
FDI	0.03299***	0.0298***	0.0323**	0.0608*
	(0.0048)	(0.0047)	(0.0051)	(0.0072)
Open	0.3203***	0.2480***	0.2878***	
	(0.0239)	(0.0240)	(0.0254)	
Exchange rate	-0.0188***	-0.0055***	-0.0088***	
	(0.0053)	(0.0024)	(0.0026)	
Inflation	-0.0537***	-0.0454***	-0.0574***	
	(0.0069)	(0.0068)	(0.0074)	
Findev1	-0.0188***			-0.0153***
	(0.0227)			(0.0086)
Findev2		0.1954***		
		(0.0148)		
Findevindex			1.90e-11***	
			(2.95e-12)	
Economic stability				0.0584***
				(0.009)

The results presented in Table 6.6 show fixed effects estimates of the relationship between FDI and economic growth conditioned on a set of explanatory variables. Columns I to IV show that there is a reliable relationship between economic growth and FDI. Holding other explanatory variables constant, the results across the four different specifications suggest that an increase in FDI ratio of 1 percent per annum increases the

per capita GDP by between 0.03 and 0.06 percent per annum. We proceed to look at the absorptive capacity effects, where we include the interaction term between FDI and absorptive capacity measures to investigate the role of FDI on economic growth through the absorptive capacity measures (Table 6.7).

Table 6. 7: Fixed Effects Results: Absorptive Capacity in the 37 Countries, Annual Data

	I	II	III	IV	V
Constant	8.8642***	8.9392***	7.6748***	5.789***	8.6858***
	(0.1143)	(0.1146)	(0.0634)	(1.1454)	(0.1324)
FDI	0.0475***	0.1305**	-0.0329***	0.2777	0.0743***
	(0.0057)	(0.0636)	(0.0160)	(0.6586)	(0.0080)
Openness	0.3218***	0.3170***	0.2321***	-0.7368*	
	(0.0237)	(0.0240)	(0.0241)	(0.3729)	
Exchange rate	-0.0108***	-0.0105***	-0.0036***	0.3817	
	(0.0023)	(0.0024)	(0.0024)	(0.1346)	
Inflation	-0.0516***	-0.0541***	-0.0433***	0.2195***	
	(0.0069)	(0.0069)	(0.0067)	(0.0990)	
Findev1	-0.0161***	-0.0194***			-0.0264***
	(0.0052)	(0.0053)			(0.0061)
Findev2			0.1967***		
			(0.0147)		
Findev index				0.0373	
				(0.0532)	
Macro stability					0.0002***
					(0.00005)
FDI*Open	0.0095***				
	(0.0021)				
FDI*Findev1		-0.0045***			
		(0.0029)			
FDI*Findev2			0.0180***		
			(0.0044)		
FDI*Findevindex				-0.0136	
				(0.0304)	
FDI*Macro stability					0.000002
					(0.00002)

Note: Absorptive capacity indicators are level of openness (OPEN); level of financial development (Findev1, Findev2 and Findevindex) and Macroeconomic stability.

The results in Table 6.7 (columns I to V) show the absorptive capacity effects. In column I, we include an interaction term of FDI and openness. This coefficient is positive and statistically significant, thus providing evidence for the hypothesis that the contribution of FDI to growth is determined by the level of openness of the economy. In column II, we investigate interaction effects with the Findev1 variable, confirming that the level of financial development is a critical absorptive capacity indicator in the growth model.

Findev2 in column III is also positive and statistically significant, however, it turns out that in this case foreign direct investment now has a negative sign, thus a negative impact on economic growth. This could be explained by the existence of nonlinearities inherent in the data, where we need to establish a threshold level for which FDI becomes positive for economic growth. This includes nonlinearities in FDI itself as well as nonlinearities in the absorptive capacity indicator. At this point we move on to investigate the FDI and growth relationship within a dynamic framework, a worthwhile move, given that such dynamics are inherent in the economic growth data.

6.3.1.2 The dynamic model

As an attempt to model the dynamics inherent in an economic growth setting, we estimate a dynamic log linear equation for economic growth with a lagged dependent variable (Equation 3.10 in Chapter 3). The application of ordinary least squares in a dynamic specification is problematic in that the lagged dependent variable is correlated with the error term. This gives rise to what Nickel (1981) has described as "dynamic panel bias". To avoid this bias, we use the GMM estimation technique recommended by Arellano and Bond (1991) (discussed in Chapter 3, Section 3.4.3). The inclusion of lagged dependent variables to account for dynamic effects can be done if the number of temporal observations is greater than the number of regressors in the model. In this model we have six regressors and thirty 32 time periods. The results from the first step GMM estimator are presented in Table 6.8.

Table 6. 8: Dynamic Panel Data Model for the Full Sample (37 Countries), Annual Data

	I	II	III	IV
Constant	0.00007	0.0003	0.0492***	-00005
	(0.0004)	(0.0010)	(0.0002)	(0.0007)
LD GDP	1.1215***	1.0893***	0.9685***	1.0126***
	(0.1069)	(0.0956)	(0.0044)	(0.1471)
FDI	0.0018*	0.0025*	-0.0093***	0.0051***
	(0.0015)	(0.0014)	(0.0012)	(0.0015)
Open	0.0102	0.0087	0.3158***	
	(0.0105)	(0.0144)	(0.0013)	
Inflation	-0.0074***	-0.0103**	0.0151	
	(0.0029)	(0.0040)	(0.0247)	
Exchange rate	0.0025***	0.0030**	-0.0487**	
	(0.0012)	(0.0014)	(0.0248)	
Findev1	-0.0012**			0.0004
	(0.0013)			(0.0015)
Findev2		-0.0088		
		(0.0146)		
Findevindex			-0.0029	
			(0.0012)	
MACRO				0.0074*
				(0.0045)
1st order serial	-3.46	-3.92	-1.15	-2.38
correlation test	[0.0005]	[0.0001]	[0.2513]	(0.0171)
2nd order serial	0.84	0.22	1.06	-0.12
correlation test	[0.4019]	[0.8249]	[0.2908]	(0.9006)

Notes: Arellano and Bond dynamic panel GMM used. Maximum 2 lags of the dependent variable used as instruments. All regressors lagged 1 period. Standard errors are in parentheses. The results for the 23 time dummies included in the model are not shown here.

The specification tests performed are the Sargan test of over-identifying restrictions which tests the joint validity of the instruments. The null hypothesis in this case is that the instruments are not correlated with the residuals. We execute the non-robust and robust dynamic estimations and choose to report the results from the robust estimations. The Sargan test is performed in the non-robust dynamic estimation and the results are not presented here. Table 6.8 shows the robust results in which the null hypothesis of no first order autocorrelation in the differenced residuals is rejected. However we fail to reject the null hypothesis of no second order serial correlation and hence conclude that our estimates are consistent regardless of the presence of first order autocorrelation. The lagged dependent variable which is the convergence variable is positive and significant in columns I-IV. This is a good finding that confirms the viability of the specified dynamic model. Some of the studies reviewed in the literature that confirms such dynamic effects include Choe (2003) and Li & Liu (2005).

The coefficients estimated in the model represent short run effects. In order to get the long run effects, we divide each of the coefficients by one less the coefficient on the lagged dependent variable. All the lagged dependent variables are positive and statistically significant, showing short run elasticities of 1.12, 1.09, 0.97 and 1.01 in columns I to IV, respectively. The coefficients of the lagged dependent variable which are greater than one reflect explosive behavior. The elasticities of GDP per capita with respect to FDI are 0.0018; 0.0025; -0.0093 and 0.0051 in the short term. The long run elasticities are -0.015; -0.028; -0.31 and 0.51. The implication is that in the short run we get largely positive effects of FDI on growth. In the long run the effects are largely negative. We also note that in the short run, FDI has a positive impact on economic growth as anticipated, except in the case where the financial development index is used as an explanatory variable. It is however important to note that the size of the coefficients is smaller in the dynamic setting than in the fixed effects model. This shows the importance of model specification in such growth regressions and in part explains why several studies in the literature have reported different results. We maintain that the dynamic model is superior, based on the confirmation of valid dynamic effects inherent in the data as presented in Table 6.8.

Comparing our findings to the empirical literature where developing and developed countries are lumped together, our findings confirm findings from De Mello (1999) who studied a panel of 32 OECD and non-OECD countries for the period spanning 1970-1990 and found positive effects of FDI on output growth. However, our results differ from the findings of Carkovic & Levine (2002) who analysed a sample of 72 mixed countries and concluded that there is no impact of the exogenous component of FDI on growth.

6.3.2 Regression results from sub-samples

A major limitation arising from the splitting of samples along spatial dimensions is that the dynamic panel data estimation is designed for a reasonably large number of countries over the entire time span. Thus in this section, we rely mainly on the static fixed effects

estimations and include dynamic estimation results whose reliability should be treated with great caution.

6.3.2.1 The Developing economies' results

In Tables 6.9 and 6.10 we present the regression results for developing countries using the fixed effects model. In Table 6.9, the results for the fixed effects show that FDI has a positive and significant effect on developing countries' economic growth. This provides us with additional evidence that FDI is beneficial to economic growth in developing countries.

Table 6. 9: Fixed Effects Results for Developing Economies, Annual Data

	I	II	III	IV	V
Constant	6.1821***	5.7129***	5.5714***	5.8607***	6.0368***
	(0.2403)	(0.1068)	(0.2087)	(0.0738)	(0.2115)
FDI	0.0243***	0.0210**	0.0198**	0.0205**	0.0275***
	(0.0069)	(0.0091)	(0.0092)	(0.0085)	(0.0062)
Open	-0.0325	-0.1360***	-0.1352***	-0.1215***	
	(0.0358)	(0.0500)	(0.0505)	(0.0451)	
Exchange rate	-0.0085	0.0084	0.0083	-0.001	
	(0.0066)	(0.0096)	(0.0094)	(0.0083)	
Inflation	-0.0465***	-0.0635***	-0.0628***	-0.0526***	
	(0.0158)	(0.0221)	(0.2242)	(0.0200)	
Findev1	-0.02378**				0.0219**
	(0.1044)				(0.0098)
Findev2		0.0230**			
		(0.0343)			
Findev 3			0.0644		
			(0.0648)		
Findevindex				-1.59e-10**	
				(-7.56)	
MACRO					0.00006***
					0.00002

Table 6.10 also presents results from a fixed effects model but includes interaction terms of FDI and the absorptive capacity measures. In this case FDI is still positive and significant in four of the model specifications. This gives us further evidence of the effect of FDI on economic growth in developing economies. Using a random effects model, for the period 1980-2000, Seetanah and Khadaroo (2007) find FDI to have a positive effect as shown by the coefficient of 0.11 on the growth of 39 Sub-Saharan African countries.

In this case we get coefficients ranging from -0.2 to 0.3 across the different specifications and using a fixed effects model. This difference in results could be explained by the different time periods, sample size and also the use of fixed effects versus random effects model.

Table 6. 10: Absorptive Capacity Effects in Developing Economies, Annual Data

	I	II	III	IV	V	VI
Constant	6.1822***	6.3626***	5.6541***	5.2699***	6.3216***	6.1131***
	(0.241)	(0.2465)	(0.1226)	(0.2507)	(0.2324)	(0.2099)
FDI	0.0245**	0.2635***	-0.0168	-0.1736**	0.2465***	0.0175**
	(0.0104)	(0.0918)	(0.0399)	(0.0911)	(0.0858)	(0.0071)
Open	-0.0324	-0.0439	-0.1358***	-0.1433	-0.0407	
	(0.0366)	(0.0355)	(0.0500)	(0.0503)	(0.0361)	
Exchange rate	-0.00857	-0.0074	0.0105	0.0117	-0.0076	
	(0.007)	(0.0066)	(0.0098)	(0.0094)	(0.0361)	
Inflation	-0.0465**	-0.0457***	-0.0620***	-0.0632***	-0.047***	
	(0.0159)	(0.0156)	(0.0222)	(0.0222)	(0.0158)	
Findev1	-0.0238**	-0.0331***				-0.0253**
	(0.0105)	(0.0109)				(0.0098)
Findev2			0.0430			
			(0.0400)			
Findev 3				0.1549**		
				(0.0770)		
Findev index					-0.033***	
					(0.0109)	
MACRO						0.0001***
						(0.00002)
FDI*Open	0.00007					
	(0.0026)					
FDI*Findev1		-0.0114**				
		(0.0044)				
FDI*Findev2			0.0430			
			(0.0400)			
FDI*Findev3				0.0636**		
				(0.0298)		
FDI*Findevindex					-0.0114**	
					(0.0044)	
FDI*Macro stability						-0.00004***
						(0.00001)

Note: Absorptive capacity indicators are level of openness (OPEN); level of financial development (Findev1, Findev2 and Findevindex) and Macroeconomic stability.

The results from Tables 6.9 and 6.10 show positive effects of FDI on economic growth in developing countries. In column I of Table 6.10, we observe a positive relationship between FDI and growth, although there is no statistical significance confirming that this effect is through openness of the economy. In column II, both FDI and the interaction

with findev1 are statistically significant. However, findev1 enters with a negative sign. Looking at the two coefficients, we get a cut off point of 23.11 (0.2635/0.0114). This implies that FDI has a negative impact on economic growth when findev1 becomes greater than 23.11 (percentage change). Conditioning on the financial development index (findevindex, column IV) results in the same effect except that in this case the cut off point is 21.62. This result is contrary to our expectation that financial development would be positive for growth. Column III of Table 6.10 shows that when allowing for the growth effect of FDI to depend on findev2, there is no reliable relationship between FDI and growth, thus both the FDI and interaction terms are statistically insignificant. The dynamic framework for developing countries is presented in Table 6.11.

Table 6. 11: Dynamic Panel Model for Developing Economies, annual Data

	I	II	III	IV	V
Constant	-0.0012	0.00006	0.000008	-0.0021	0.00029
	(0.0022)	(0.0017)	(0.0015)	(0.0018)	(0.00098)
Lagged dependent variable	0.7497***	0.8961***	0.7888***	0.6844***	0.9203***
	(0.1120)	(0.0929)	(0.0709)	(0.0936)	(0.1662)
FDI	0.0062**	0.0051***	0.0016	0.0025	0.0061***
	(0.0027)	(0.0019)	(0.0015)	(0.0020)	(0.0017)
Open	0.0094	0.0005	0.0351	0.0425***	
	(0.0108)	(0.0123)	(0.0138)	(0.0107)	
Inflation	-0.0116**	-0.0157**	-0.0172***	-0.0157***	
	(0.0059)	(0.0069)	(0.0049)	(0.0053)	
Exchange rate	0.0069	-0.0001	0.0097	0.0142**	
	(0.0118)	(0.0109)	(0.0067)	(0.0071)	
Findev1	-0.0013				-0.0002
	(0.0042)				(0.0036)
Findev2		0.0079			
		(0.0108)			
Findev3			-0.0536		
			(0.0138)		
Findevindex				-0.0010	
				(0.0031)	
MACRO					0.000003
					0.00001
1st order serial correlation test	-2.23	-4.47	-1.86	-2.12	-2.30
	[0.0260]	[0.000]	[0.0625]	[0.0342]	[0.0213]
2nd order serial correlation test	-1.38	-1.20	-1.72	-1.08	0.01
	[0.1673]	[0.2315]	[0.0853]	[0.2814]	[0.9958]

Notes: Arellano and Bond dynamic panel GMM used. Maximum 2 lags of the dependent variable used as instruments. Standard errors are in parentheses. The results for the time dummies included in the model are not shown here

The dynamic model for developing countries shows positive and significant lagged dependent variables ranging from 0.68 to 0.92. This implies that the coefficient of partial adjustment lies between 0.08 and 0.32. Hence per capita GDP in one year is between 8% and 32% of the difference between the optimal and the current level of per capita GDP. The positive and significant lagged dependent variables in this case confirm the existence of dynamic effects in the model. We also note that compared to the results in Table 6.8 where dynamic effects were modeled for all the countries grouped together, in this case the coefficients are less than one and hence reflecting non-explosive behaviour for developing countries (Tables 6.14 and 6.17 depict explosive behavior for emerging and developed economies). This serves to confirm the view that grouping heterogeneous countries together is inappropriate.

The positive and significant effect of FDI on growth in developing economies is in line with the findings of Borensztein et al. (1998) who studied 69 developing countries and concluded that FDI is an important channel for technology transfer. Blomstrom et al. (1992) found a strong effect of FDI on economic growth in developing countries. In order to examine whether there is a difference in results between developing and emerging economies, in Section 6.3.2.2 we present and discuss emerging economy results.

6.3.2.2 The Emerging Economies Results

Subjecting the emerging economies' data to the same estimation techniques performed on the developing country data, we get the results presented in Table 6.12 and Table 6.13.

Table 6. 12: Fixed Effects Model for Emerging Economies, Annual Data

	I	II	III	IV	V
Constant	6.0338***	6.2291***	5.0023***	5.4607***	5.2858***
	(0.3075)	(0.1287)	(0.1612)	(0.1949)	(0.1676)
FDI	0.0199*	0.0184*	0.0091	0.0159	0.0773***
	(0.0115)	(0.0102)	(0.0095)	(0.0103)	(0.0108)
Open	0.3715***	0.4730***	0.2870***	0.4073***	
	(0.0518)	(0.0464)	(0.0437)	(0.0474)	
Exchange rate	0.0635***	0.0595***	0.0563***	0.0480***	
	(0.0155)	(0.0135)	(0.0126)	(0.0139)	
Inflation	-0.0298**	-0.0091	0.0305***	-0.0145	
	(0.0122)	(0.0104)	(0.0103)	(0.0108)	
Findev1	0.3458***				0.4049***
	(0.042)				(0.416)
Findev2		0.3197***			
		(0.0289)			
Findev 3			0.5811***		
			(0.0378)		
Findevindex				0.4332***	
				(0.0407)	
Macro stability					0.0001***
					(0.00003)

Table 6. 13: Absorptive Capacity Effects for Emerging Economies

	I	II	III	IV	V	VI
Constant	5.9017***	5.9408***	7.0278***	5.703***	6.1193***	5.0913***
	(0.1812)	(0.2415)	(0.2087)	(0.3925)	(0.4012)	(0.1209)
FDI	0.0350**	0.0158	-0.1874***	-0.001	-0.1424*	0.0360***
	(0.0150)	(0.0163)	(0.0322)	(0.0701)	(0.0851)	(0.0099)
Open	0.2908***	0.3805***	0.4713***	0.2690***	0.4114***	
	(0.0728)	(0.0523)	(0.0474)	(0.0478)	(0.0473)	
Exchange rate	0.0733***	0.0674***	0.0616***	0.0587***	0.0547***	
	(0.016)	(0.0160)	(0.0143)	(0.0141)	(0.0143)	
Inflation	-0.0267**	-0.0286**	-0.0097	0.0280***	-0.0119	
	(0.0121)	(0.0121)	(0.0111)	(0.0113)	(0.0108)	
Findev1	0.3238***	0.3356***				
	(0.0431)	(0.0591)				
Findev2			0.0963**			
			(0.0482)			
Findev 3				0.029***		0.5559***
				(0.0173)		(0.0353)
Findev index					0.2871***	
					(0.0879)	
Macro stability						-0.00003***
						(0.00007)
FDI*Open	0.0245*					
	(0.0139)					
FDI*Findev1		0.00002				
		(0.00014)				
FDI*Findev2			0.0532***			
			(0.0076)			
FDI*Findev 3				0.0290*		
				(0.0173)		
FDI*Findevindex					0.0338*	
					(0.0180)	
FDI*Macro stability						0.00002
						(0.00001)

Note: Absorptive capacity indicators are level of openness (OPEN); level of financial development (Findev1, Findev2 and Findevindex) and Macroeconomic stability.

We consider the emerging economy results in Table 6.13 and compare the results to the findings for developing economies. Here we note that in column I, when we allow for the growth effect of FDI to occur through openness, there is a reliable positive relationship between FDI and growth. While in the developing country results we observed that opening up the economy does not enhance FDI led growth, in the case of emerging economies we advocate for policies that further open the economy so as to take advantage of these effects. In column II, both FDI and the interaction term with findev1 do not show a reliable relationship between FDI and growth. In column III, while we confirm that the FDI-growth relationship depends on findev2, as long as findev2 is below 3.52 (annual percentage change) the growth effect of FDI would be negative. The results

in column V are similar to those of column III. The main difference is that the interaction term is for the financial development index and it has a threshold value of 4.21. In Table 6.14, we show the results from dynamic estimation for emerging economies.

Table 6. 14: Dynamic Estimation for Emerging Economies, Annual Data

	I	II	III	IV	V
Constant	0.0046***	0.0020**	0.0034***	0.0034***	0.0029**
	(0.0016)	(0.0010)	(0.0011)	(0.0012)	(0.0014)
Lagged dependent variable	1.0870***	1.1788***	1.0833***	1.1333***	1.1244***
	(0.1905)	(0.1575)	(0.1777)	(0.1509)	(0.1363)
FDI	-0.0006	0.0004	-0.0024	0.0003	-0.0012
	(0.0024)	(0.0026)	(0.0022)	(0.0026)	(0.0029)
Open	0.0363	0.0427	0.0587***	0.0494**	
	(0.0258)	(0.0260)	(0.0169)	(0.0206)	
Inflation	0.0001	-0.0043	0.0008	-0.0002	
	(0.0045)	(0.0046)	(0.0034)	(0.0043)	
Exchange rate	-0.0127	-0.0029	0.0035	-0.0061	
	(0.0125)	(0.0094)	(0.0065)	(0.0097)	
Findev1	-0.0215				-0.0344
	(0.0250)				(0.0211)
Findev2		-0.0004			
		(0.0171)			
Findev3			0.0304		
			(0.0195)		
Findevindex				-0.0080	
				(0.0209)	
MACRO					0.00001
					(0.00002)
1st order serial correlation test	-2.63	-2.46	-2.49	-2.50	-2.72
	[0.0085]	[0.0139]	[0.0126]	[0.0123]	[0.0065]
2nd order serial correlation test	1.49	1.36	1.51	1.40	1.01
	[0.1357]	[0.1738]	[0.1305]	[0.1604]	[0.3123]

For emerging economies, the dynamic specification results in a largely negative and insignificant impact of FDI on economic growth. A review of the literature shows a limited number of studies based on emerging economies. Campos and Kinoshita (2002) studied the effects of FDI on economic growth in 25 transitional economies and found that FDI is a significant determinant of economic growth.

6.3.2.3 Developed Country Results

The results in Table 6.15 show statistically significant results confirming the growth enhancing effects of FDI. The effects vary, depending on the absorptive capacity measure adopted in the equation.

Table 6. 15: Fixed Effects Model for Developed Countries, Annual Data

	I	II	III	IV
Constant	9.6328***	9.7635***	9.6289***	8.5239***
	(0.0733)	(0.558)	(0.0707)	(0.0853)
FDI	0.0165***	0.0165***	0.0165***	0.0459***
	(0.0034)	(0.0034)	(0.0034)	(0.0047)
Open	0.4678***	0.4843***	0.4707***	
	(0.0220)	(0.0207)	(0.0215)	
Exchange rate	-0.0097***	-0.0041**	-0.0074***	
	(0.0027)	(0.0026)	(0.0026)	
Inflation	-0.0141***	-0.0140***	-0.0143***	
	(0.0056)	(0.0055)	(0.0055)	
Findev1	0.1280***			0.3116***
	(0.0143)			(0.0180)
Findev2		0.1060***		
		(0.0112)		
Findevindex			0.1224***	
			(0.0131)	
MACRO				-0.0544***
				(0.0047)

Table 6. 16: Absorptive Capacity Effects for Developed Countries, Annual Data

	I	II	III	IV	V
Constant	9.6541***	9.5958***	9.7299***	9.5841***	9.5294***
	(0.0734)	(0.0740)	(0.0560)	(0.0713)	(0.0226)
FDI	0.0230***	0.0965*	0.1136***	0.1176***	0.0853***
	(0.0043)	(0.0287)	(0.0287)	(0.0316)	(0.0073)
Open	0.4666***	0.4726***	0.4961***	0.4783***	
	(0.0219)	(0.0219)	(0.0208)	(0.0214)	
Exchange rate	-0.0091***	-0.0099**	-0.0030***	-0.0072***	
	(0.0026)	(0.0026)	(0.0026)	(0.0026)	
Inflation	-0.0161***	-0.0110	-0.0102**	-0.0107**	
	(0.0056)	(0.0056)	(0.0056)	(0.0056)	
Findev1	0.1223***	-0.1360***			0.0029***
	(0.0144)	(0.0145)			(0.0002)
Findev2			0.1142***		
			(0.0113)		
Findev index				0.1317***	
				(0.0133)	
Macro stability					-0.0002***
					(0.00008)
FDI*Open	0.0110***				
	(0.0043)				
FDI*Findev1		-0.0178			
		(0.0063)			
FDI*Findev2			-0.0226***		
			(0.0066)		
FDI*Findevindex				-0.0213***	
				(0.0066)	
FDI*MACRO					-0.0122***
					(0.0032)

The inclusion of the openness interaction term in Table 6.16 shows that the growth enhancing effects of FDI through all absorptive capacity indicators but findev1 are positive and significant. We now consider the dynamic model for developed economies.

Table 6. 17: Dynamic Panel Model for Developed Countries, Annual Data

	I	II	III	IV
Constant	-0.0007	-0.0007**	-0.0074***	0.0009***
	(0.0004)	(0.0004)	(0.0015)	(0.0003)
Lagged dependent	1.2631***	1.2622***	1.2629***	1.3112***
variable	(0.0361)	(0.0372)	(0.0361)	(0.0358)
FDI	0.0015	0.0015***	0.0015***	0.0018***
	(0.0010)	(0.00097)	(0.00097)	(0.0009)
Open	0.0518***	0.0522***	0.0518***	-0.0482***
	(0.0111)	(0.0111)	(0.0111)	(0.0171)
Inflation	-0.0074***	-0.0074***	-0.0074***	
	(0.0015)	(0.0015	(0.0015)	
Exchange rate	-0.0007	-0.0006		
	(0.0015)	(0.0007)		
Findev1	0.0015			
	(0.0053)			
Findev2		0.0042		
		(0.0042)		
Findevindex			0.0027	-0.0004***
			(0.0049)	(0.0009)
MACRO				
1st order serial	-8.72	-8.74	-8.73	-8.59
correlation test	(0.0000)	[0.0000]	[0.0000]	[0.0000]
2nd order serial	-0.24	-0.22	-0.23	-0.64
correlation test	(0.8131)	[0.8272]	[0.8159]	[0.5194]

The results presented in Table 6.17 are for the developed economy dynamic panel data analysis. The impact of FDI on economic growth in this case is not statistically significant. It turns out that openness of the economy and the level of inflation in the economy are significant variables in the regression equation.

6.3.3 Marginal effects in the annual data

In this section we present the marginal effects of FDI evaluated at the mean, minimum and maximum levels of the respective absorptive capacity indicators. These partial derivatives vary with the level of absorptive capacity as shown in equation 6.14 and the accompanying Tables 6.18 – 6.21.

Generally, the marginal effects are calculated as follows

$$\frac{\partial \ln GDPPC}{\partial \ln FDI} = \beta_{fdi} + \beta_{abs} \ln ABSCAP , \qquad (6.14)$$

Where β_{fdi} represents the beta coefficient associated with FDI and β_{abs} is the beta coefficient associated with the absorptive capacity indicator.

Table 6. 18: Marginal Effects for 37 Countries

Indicator	Evaluated at		
	Minimum	Mean	Max
Openness	0.0394	-0.0103	0.0534
Findev1	0.0329	0.0579	0.0269
Findev2	0.0335	0.0251	0.0651
Finindex	-0.0156	-0.0156	-0.0282
Macrostability	0.07430	0.07429	0.07431

Table 6. 19: Marginal Effects for Developing Economies

Indicator	Evaluated at		
	Minimum	Mean	Max
Openness	0.0240	0.0244	0.0245
Findev1	0.0639	0.0189	0.0014
Findev2	-0.0106	0.0188	0.0343
Finindex	0.0633	0.0182	0.0007
Macrostability	-0.1216	0.0267	0.0170

Table 6. 20: Marginal Effects for Emerging Economies

Indicator	Evaluated at		
	Minimum	Mean	Max
Openness	-0.0379	0.0124	0.0477
Findev1	0.0158	0.0159	0.0159
Findev2	-0.0726	0.0143	0.0845
Findev3	0.0520	0.1084	0.1448
Finindex	-0.0461	0.0110	0.0468
MACRO	0.0014	0.0388	0.1227

Table 6. 21: Marginal Effects for Developed Economies

Indicator	Evaluated at		
	Minimum	Mean	Max
Openness	0.2214	0.2053	0.2369
Findev1	0.0547	0.0771	0.0275
Findev2	0.0171	0.0484	-0.0088
Finindex	0.0296	0.0576	0.0017
MACRO	-0.0165	0.0189	-0.0560

From Table 6.21, we observe that at the lowest levels of Openness, Findev2 and Macroeconomic stability, FDI registers negative or very small effects on growth and these are highest at the maximum level of absorptive capacity. The opposite is true for Findev1 and Findevindex, where the marginal effects are higher at lower levels and become smaller at the higher end of absorptive capacity. The marginal effects show that for countries with absorptive capacity measures equal to the mean, there are positive contributions of FDI to economic growth. These marginal effects for the entire sample have similar interpretation to the marginal effects in Table 6.19 for developing countries.

Looking at the marginal effects for emerging economies in Table 6.20, we note that in this case FDI registers negative effects at the lowest levels of openness, Findev2 and MACRO. In the case of developed economies (Table 6.21), we note that there are negative effects of FDI at the minimum and mean levels of openness. In this case some countries with the mean level of openness still register negative FDI growth effects. This suggests that for developed economies, a high level of openness would be ideal for economic growth.

6.4 Estimation using five year averaged data

Averaging data over five year periods presents us with an opportunity to explore a third absorptive capacity indicator – human capital- as measured by the level of education in a country. The main dataset remains the same as that summarized above. The main changes occurring are that the data is now averaged over five years and hence giving us seven

data points in the period of study (1975-2006). In Table 6.22, we present the summary statistics of the dependent variable, per capita GDP and the explanatory variables (FDI, Openness [Open], Education [Educ] and three financial development indicators [Findev1, Findev2, Findev3]).

6.4.1 Descriptive Statistics for the five year averaged data

Table 6. 22: Summary Statistics for the Five Year Averaged Data

Variable	Obs	Mean	Std. Dev.	Min	Max
		Developing Countries			
GDP per capita	42	693.855	993.095	132.500	4402.779
FDI	42	2.532308	4.528355	-0.988105	26.97913
Openness	42	0.885071	0.382839	0.245894	1.574292
Education	36	3.303333	1.047394	1.540000	5.560000
Findev1	41	22.73717	29.11270	-55.17366	74.16538
Findev2	42	14.24646	8.191937	1.918805	31.94686
Findev3	42	24.15415	7.591850	12.17367	42.23257
		Emerging Economies			
GDP per capita	77	2341.159	1977.471	155.253	8393.372
FDI	77	1.979268	2.575123	-0.811000	18.44879
Open	77	0.517445	0.357468	0.081786	1.445707
Education	66	4.731515	1.597865	1.320000	8.490000
Findev1	76	77.73612	40.61825	12.09242	223.7564
Findev2	76	55.71364	32.82932	12.34256	151.1595
Findev3	77	52.23801	32.62349	12.02410	151.3826
		Developed Countries			
GDP per capita	112	20289.85	6679.753	8651.42	39392.86
FDI	112	2.09002	3.9071	-7.7676	31.0273
Openness	112	8.5657	1.6667	4.49	12.25
Education	97	8.397222	1.177024	5.910000	10.20000
Findev1	112	113.6978	66.52603	35.92083	427.8816
Findev2	112	87.9062	44.2026	25.03407	217.423

In Table 6.22, we note the heterogeneity existing in the panels using the five year averaged data. The minimum per capita GDP is 132.5 for Ghana, compared to the minimum of 100.49 (Burundi in 2005) in the annual data. The maximum per capita GDP is 30 287.66 (Ireland in the period 2004-2005) in the five year averaged data. Averaging data over five years leaves us with seven non-overlapping data points, where the seventh period is two year average (2005-2006) and thus the number of observations is now lower than in the case where we explored annual data.

6.4.2 Pair wise correlations for the five year averaged data

In order to investigate whether there is independent variation in the variables, we present pair wise correlations in Tables 6.23 to 6.25. In the case of five year averaged data, we focus on the three country groupings separately as we have noted in section 6.2 that the results from pooling the 37 countries together cannot be generalized due to the heterogeneity across countries.

Table 6.23: Developing Country Pair Wise Correlations

	Lngdppc	FDI	Open	Educ	Findev1	Findev2	Findev3
Lngdppc	1.000000						
FDI	0.145167	1.000000					
Open	0.063815	0.357641	1.000000				
Educ	0.324544	0.314984	0.070763	1.000000			
Findev1	-0.62598	-0.242156	-0.51442	-0.20008	1.000000		
Findev2	0.195084	-0.042423	-0.337371	-0.18637	0.298463	1.000000	
Findev3	0.236608	0.149976	0.220890	0.104471	0.113556	0.648452	1.000000

Table 6.24: Emerging Economy Pair Wise Correlations

	Lngdppc	FDI	Open	Educ	Findev1	Findev2	Findev3
Lngdppc	1.0000						
FDI	0.30498	1.000000					
Open	-0.03334	0.208931	1.000000				
Educ	0.59414	0.515269	0.047754	1.000000			
Findev1	0.236076	0.263355	0.285513	0.202813	1.000000		
Findev2	0.179497	0.289155	0.327560	0.307544	0.86766	1.00000	
Findev3	-0.113713	0.32654	0.64710	0.12054	0.5909	0.568	1.0000

Table 6.25: Developed Economy Pair Wise Correlations

	Lngdppc	FDI	Open	Educ	Findev1	Findev2
Lngdppc	1.000000					
FDI	0.559613	1.000000				
Open	0.526149	0.885874	1.000000			
Educ	0.887512	0.273681	0.364562	1.000000		
Findev1	0.889938	0.298131	0.206272	0.874298	1.0000	
Findev2	0.944454	0.471839	0.449699	0.849799	0.886786	1.00000

In an attempt to find a better proxy for the level of financial development, we use the principal components analysis to construct financial development indices for the five year averaged data. These are useful in testing the role of financial development in economic growth in the same way as in the section on annual data. The indices are shown in

equations 6.9 to 6.11 for developing, emerging and developed economies, respectively. In square brackets, we show the correlation of the new index with per capita GDP. For developed countries, only FINDEV1 and FINDEV2 have been used because of the absence of the FINDEV3 data in the WDI data set that we have used for this analysis.

$$FINDEV_{INDEX1} = 0.353FINDEV1 + 0.685FINDEV2 + 0.637FINDEV3, \quad (6.9)$$

[-0.41]

$$FINDEV_{INDEX2} = 0.607FINDEV1 + 0.609FINDEV2 + 0.510FINDEV3 \quad (6.10)$$

[0.10]

$$FINDEV_{INDEX3} = 0.707FINDEV1 + 0.707FINDEV2 \quad (6.11)$$

[0.92]

For the five year averaged data, the MACRO indices are shown in equations 6.12 to 6.14.

` $$MACRO_1 = 0.704OPEN + 0.189EXRATE - 0.685INFCPI \quad (6.12)$$

[-0.412]

$$MACRO_2 = 0.667OPEN + 0.377EXRATE - 0.643INFCPI \quad (6.13)$$

[-0.22]

$$MACRO_3 = -0.7154OPEN + 0.0862EXRATE + 0.6934INFCPI \quad (6.14)$$

[0.26]

The descriptive statistics presented in this section show diverse correlations in the developing, emerging and developed economies for both annual data and five year averaged data. This further justifies the approach of separating the countries into three distinct groups. The simple correlations seem to reveal that financial development is more effective in the developed countries. Economic theory is ambiguous on the issue of

whether financial development effectiveness in influencing growth depends on the level of development (Patrick, 1966; Rajan & Zingales, 1998). In the following sections, we subject the data described here to rigorous panel data analyses that will assist in drawing a more informed inference about the relationship between growth and FDI.

6.4.3 Regression results from the five year averaged data

Taking into consideration the debate about the use of five year averages, we note that the use of such data in our analysis is critical because it allows us to investigate the influence of human capital on economic growth. The hypothesis that FDI without human capital is not important for growth can be tested if there is a proxy to measure human capital. After an intensive search of this variable, the Barro and Lee (2001) data set which provide the education variable in 5 year averages is a good indicator for the level of education. Thus, the desire to find the effects of human capital confines us to the use of five year averaged data in our analysis.

6.4.3.1 The Developing countries' results

In this section we estimate a general model to give us an indication of how the explanatory variables explain economic growth. The general static equation estimated is specified as:

$$GDPPC_{it} = \alpha_i + \beta_{1i} OPEN_{it} + \beta_{2i} EDU_{it} + \beta_{3i} FINDEV_{it} + \beta_{4i} INFL_{it} + \beta_{5i} FOREX_{it} + \varepsilon_{it} \quad , \qquad (6.14)$$

This model relates economic growth as proxied by per capita GDP to openness, education, financial development, inflation and the exchange rate. All the variables are in log form in our estimation. The estimation results are presented in Table 6.26 and 6.27.

Table 6.26: Fixed Effects Results for Developing Countries, Five Year Averaged Data

	I	II	III	IV	V
Constant	5.5885***	4.8436***	4.9378***		5.1455***
	(0.2989)	(0.4548)	(0.6087)		(0.3728)
FDI	0.0941**	0.1032**	0.1077**		0.1191**
	(0.0324)	(0.0399)	(0.0453)		(0.0467)
Open	-0.0317	-0.1693	-0.1592		-0.2353
	(0.0860)	(0.1468)	(0.1589)		(0.2103)
Education	0.2953**	0.8774***	0.8932***		0.7472***
	(0.1305)	(0.1638)	(0.1869)		(0.1586)
Exchange rate	-0.0367**	-0.0696**	-0.0721**		-0.0769
	(0.0158)	(0.0258)	(0.0292)		(0.0248)
Inflation	0.0237	0.0339	0.0335		0.0337
	(0.0517)	(0.0951)	(0.0921)		(0.0828)
Findev1	-0.0740				-0.0063**
	(0.0494)				(0.0025)
Findev2		0.0046			
		(0.0942)			
Findev 3			-0.0307		
			(0.1875)		
Findevindex					
Macro stability					0.0002
					(0.0004)

Notes: **significant at 5%
*significant at 10%
The dependent variable is log per capita GDP and all explanatory variables are in the log form

The FDI variable is interacted with a measure of absorptive capacity, suggested in the literature to be openness, human capital (EDUC) and the level of financial development. Thus different models are estimated with three different interaction terms to capture the absorptive capacity condition. The results for the panel estimation are shown in Table 6.27.

Table 6.27: Absorptive Capacity for Developing Economies, Five Year Averaged Data

	I	II	III	IV	V	VI
Constant	5.2303***	5.1898***	5.4218***	4.5891***	4.3996***	5.1595***
	(0.3543)	(0.2991)	(0.2906)	(0.4996)	(0.6224)	(0.3648)
FDI	0.1079**	-0.1898	0.2702**	-0.0708	-0.6114	0.1193**
	(0.0468)	(0.1260)	(0.0986)	(0.1532)	(0.3552)	(0.0469)
Open	-0.1369	-0.1270	-0.0246	-0.1158	-0.0767	-0.2279
	(0.1377)	(0.1107)	(0.0797)	(0.1523)	(0.1526)	(0.2019)
Education	0.7379***	0.6192***	0.1510	0.9524***	0.9484***	0.7459***
	(0.1590)	(0.1441)	(0.1433)	(0.1743)	(0.1752)	(0.1584)
Exchange rate	-0.0708***	-0.0586**	-0.0179	-0.0671**	-0.0632**	-0.0754***
	(0.0233)	(0.0203)	(0.0177)	(0.0256)	(0.0274)	(0.0239)
Inflation	0.0204	0.0480	0.0353	0.066	0.0897	0.0289
	(0.0819)	0.0700	(0.0483)	(0.0980)	(0.0896)	(0.0812)
Findev1	-0.0066**	-0.0046*	0.0036			
	(0.0025)	(0.0022)	(0.0617)			
Findev2				0.0403		
				(0.0981)		
Findev3					0.0697	
					(0.1805)	
Macro stability						0.0002
						(0.0004)
FDI*Open	-0.0171					
	(0.0844)					
FDI*Educ		0.2425**				
		(0.0969)				
FDI*Findev1			-0.0617**			
			(0.0329)			
FDI*Findev2				0.0771		
				(0.0656)		
FDI*Findev3					0.2330*	
					(0.1143)	
FDI*Macrostability						0.00014
						(0.00027)

Note: Absorptive capacity indicators are level of openness (OPEN); level of financial development (Findev1, Findev2 and Findevindex) , Macroeconomic stability and the level of education (Educ).

In Table 6.27, FDI and the absorptive capacity indicators are statistically significant. However all the other explanatory variables have the expected signs but are not statistically significant.

6.4.3.2 The Emerging Economies' Results

In this section we now consider the emerging economies' five year averaged data and estimate a fixed effects model, the outcome of which is presented in Table 6.28 and Table 6.29.

Table 6.28: Fixed Effects Model for Emerging Economies, Five Year Averaged Data

	I	II	III	IV	V
Constant	6.7314***	6.9414***	6.6872***	6.8492***	3.7780***
	(0.2338)	(0.2133)	(0.1840)	(0.2113)	(0.4091)
FDI	0.0049	0.0205	0.0386	0.0222	0.0518
	(0.0433)	(0.0391)	(0.0346)	(0.0387)	(0.0447)
Open	0.4381**	0.4319**	0.1983	0.3838**	
	(0.1817)	(0.1626)	(0.1484)	(0.1659)	
Education	0.5834***	0.4372***	0.1901	0.3904**	1.4189***
	(0.1550)	(0.1518)	(0.1464)	(0.1520)	(0.2910)
Exchange rate	-0.0223**	-0.0185**	-0.0109	-0.0185	
	(0.0092)	(0.0085)	(0.0075)	(0.0085)	
Inflation	-0.0178	-0.0072	0.0108	-0.0128	
	(0.0314)	(0.0273)	(0.023)	(0.0276)	
Findev1	0.0029**				0.2714***
	(0.0014)				(0.0916)
Findev2		0.0046***			
		(0.0016)			
Findev 3			0.011304		
			(0.1840)		
Findevindex				0.0033***	
				(0.0010)	
Macro policy					0.00002
					(0.0266)

In Table 6.28, the coefficients of all explanatory variables appear with the expected signs. However, our variable of interest, FDI is not statistically significant in all specifications in Table 6.28. These results confirm the findings from annual data where the impact of FDI on economic growth in emerging economies is positive but statistically insignificant.

Table 6. 29: Absorptive Capacity Effects for Emerging Economies, Five Year Averaged Data

	I	II	III	IV	V	VI
Constant	6.7413***	5.8036***	5.7167***	6.1427***	5.564***	4.9307
	(0.2349)	(0.3879)	(0.3907)	(0.2973)	(0.4337)	(0.3659)
FDI	0.0294	-0.1436	-0.1823	-0.1670	-0.1559	0.0101
	(0.0521)	(0.1273)	(0.2162)	(0.1786)	(0.2386)	(0.0330)
Open	0.4832**	0.5037***	0.4576***	0.5339***	0.4752***	0.3351**
	(0.1898)	(0.1666)	(0.1631)	(0.1456)	(0.1530)	(0.1367)
Education	0.6160***	0.5253***	0.5294***	0.3704**	0.4248***	0.3336**
	(0.1602)	(0.1407)	(0.1419)	(0.1403)	(0.1392)	(0.1240)
Exchange rate	-0.0214**	-	-0.0219**	-0.0173**	-0.0204**	-
	(0.0093)	0.0256***	(0.0087)	(0.0079)	(0.0083)	0.0207***
		(0.0085)				(0.0068)
Inflation	-0.0161	-0.0028	-0.0194	-0.0030	-0.0083	0.0361
	(0.0316)	(0.0321)	(0.0291)	(0.0251)	(0.0268)	(0.0245)
Findev1	0.0024	0.2972***	0.3176***			
	(0.0014)	(0.0928)	(0.0943)			
Findev2				0.3207		
				(0.0839)		
Findevindex					0.3643***	
					(0.1007)	
Macro policy						
FDI*Open	0.0339					
	(0.0398)					
FDI*Educ		0.0962				
		(0.0828)				
FDI*Findev1			0.0420			
			(0.0498)			
FDI*Findev2				0.0452		
				(0.0441)		
FDI*Findevindex					0.0348	
					(0.0504)	
FDI*Macro						0.00006
policy						(0.0001)

Note: Absorptive capacity indicators are level of openness (OPEN); level of financial development (Findev1, Findev2 and Findevindex) , Macroeconomic stability and the level of education (Educ).

After controlling for absorptive capacity measures (as reported in Table 6.29), the coefficient on FDI is still statistically insignificant. This provides strong evidence of the absence of FDI led growth in the sample of emerging economies, where data has been averaged over five year periods. Furthermore, all the interaction terms are statistically insignificant, a confirmation of the absence of FDI effects even after conditioning on the absorptive capacity variables. Given that the analysis using annual data showed the existence of positive effects of FDI for emerging market economies, the absence of significant effects could be explained by the loss of data during averaging.

6.4.3.3 The Developed economies' results

Table 6.30: Fixed Effects Results for Developed Countries, Five Year Averaged Data

	I	II	III	IV
Constant	9.2273***	9.2450***	9.1540***	7.0008***
	(0.4552)	(0.4249)	(0.4487)	(0.2754)
FDI	0.0302**	0.0294**	0.0298**	0.0594***
	(0.0116)	(0.0114)	(0.0115)	(0.0121)
Open	0.3848***	0.3848***	0.3790***	
	(0.0723)	(0.0689)	(0.0708)	
Education	0.1470	0.1795	0.1651	0.8166***
	(0.1579)	(0.1550)	(0.1562)	(0.1232)
Exchange rate	0.0037	0.0041	0.0038	
	(0.0026)	(0.0025)	(0.0052)	
Inflation	-0.0191	-0.0176	-0.0187	
	(0.0192)	(0.0188)	(0.0190)	
Findev1	0.1329***			0.2396***
	(0.0375)			(0.0386)
Findev2		0.1202***		
		(0.0294)		
Findevindex			0.1327***	
			(0.0343)	
Economic stability				0.0016
				(0.0030)

Table 6.31: Absorptive Capacity Effects for Developed Economies, Five Year Averaged Data

	I	II	III	IV	V	VI
Constant	9.1841***	9.7268***	9.2018***	9.1783***	9.1008***	7.1642***
	(0.4524)	(0.4681)	(0.4581)	(0.4245)	(0.4509)	(0.2825)
FDI	0.0377	0.3345***	0.0943	0.1590*	0.1365	0.0566***
	(0.0126)	(0.1074)	(0.0888)	(0.0925)	(0.0999)	(0.0120)
Open	0.3672***	0.4524	0.3936***	0.4084***	0.3935***	
	(0.0726)	(0.0729)	(0.0735)	(0.0704)	(0.0720)	
Education	0.1825	-0.0632	0.1432	0.1815	0.1627	0.7703***
	(0.1584)	(0.1676)	(0.1585)	(0.1540)	(0.1560)	(0.1230)
Exchange rate	0.0044	0.0031*	0.0035	0.0038	0.0035	
	(0.0026)	(0.0025)	(0.0026)	(0.0025)	(0.0025)	
Inflation	-0.0277	-0.0137	-0.0164	-0.0100	-0.0139	
	(0.0200)	(0.0184)	(0.0197)	(0.0194)	(0.0195)	
Findev1	0.1228**	0.1338***	0.1408***			0.2303***
	(0.0378)	(0.0358)	(0.0392)			(0.0381)
Findev2				0.1363***		
				(0.0313)		
Findevindex					0.1457***	
					(0.0363)	
Economic stability						-0.0203*
						(0.0115)
FDI*Open	0.0178					
	(0.0120)					
FDI*Educ		-0.1404***				
		(0.0493)				
FDI*Findev1			-0.0145			
			(0.0199)			
FDI*Findev2				-0.0307		
				(0.0217)		
FDI*Findevindex					-0.0228	
					(0.0212)	
FDI*Macro policy						-0.0071*
						(0.0036)

Note: Absorptive capacity indicators are level of openness (OPEN); level of financial development (Findev1, Findev2 and Findevindex) , Macroeconomic stability and the level of education (Educ).

6.4.4 Marginal effects in the five year averaged data

Repeating the procedure undertaken in Section 6.3.3, we calculate the marginal effects of FDI for the five year averaged data evaluated at the mean, minimum and maximum levels of the respective absorptive capacity indicators and present the results in Tables 6.32 to 6.34. Similar interpretations as in section 6.4.3 apply here.

Generally, the marginal effects are calculated as follows

$$\frac{\partial \ln GDPPC}{\partial \ln FDI} = \beta_{fdi} + \beta_{abs} \ln ABSCAP , \qquad (6.4)$$

Where β_{fdi} represents the beta coefficient associated with FDI and β_{abs} is the beta coefficient associated with the absorptive capacity indicator.

Table 6.32: Marginal Effects for Developing Countries

Indicator	Evaluated at		
	Minimum	Mean	Max
Openness	0.1319	0.1118	0.1001
Findev1	0.2292	0.0682	0.0045
Findev2	-0.0206	0.1199	0.1963
Education	-0.0852	0.0878	0.2261
Findev3	-0.0291	-0.3446	0.2608
Macro policy	0.1194	0.1195	0.1198

Table 6.33: Marginal Effects for Emerging Economies

Indicator	Evaluated at		
	Minimum	Mean	Max
Openness	-0.0555	-0.0014	0.0419
Findev1	-0.0776	-0.0054	0.0450
Findev2	-0.0534	0.0068	0.0598
Education	-0.1169	0.00014	0.0622
Finindex	-0.0460	0.0029	0.0373
Macro policy	-0.1169	0.00014	0.0622

Table 6.34: Marginal Effects for Developed Countries, Five year Averaged Data

Indicator	Evaluated at		
	Minimum	Mean	Max
Openness	0.0244	-0.0008	0.0483
Findev1	0.0275	0.0424	0.0064
Findev2	0.0256	0.0601	-0.0019
Education	0.0358	1.2910	-0.0173
Finindex	0.0263	0.0497	-0.0019
Macro policy	0.0455	0.0651	-0.1700

6.5 Conclusion

This Chapter investigated the FDI-Growth relationship for developing, emerging and developed economies for the period spanning 1975-2006. The general findings of our analysis are that FDI, openness, financial development and the stability of the macro economy are statistically significant determinants of economic growth across countries for the period 1975-2006. We compared the results from the annual data to those of averaged data and detected the differences in coefficient sizes which are a result of the removal of cyclical fluctuations.

Comparing the results from the three different groups, we find that the FDI effects on the developing country growth are less than the effects in emerging and developed economies. The reason could be the low volumes of FDI flowing into developing countries compared to the flows into the other two groups (see Figure 3.1, Chapter 3). The impact is also smaller in this set of countries than what De Gregorio (1992) found in Latin American countries, Wang (2002) for the Asian economies and Campos and Kinoshita (2002) for the transition economies. Overall, there is clear evidence provided in this chapter that results differ depending on the functional form as well as the estimation method. The dynamic framework employed in this case confirmed that FDI does not only cause growth but also follows growth, a finding that we also obtained in the time series analysis using the Toda-Yamamoto framework.

CHAPTER 7: CONCLUSION

> "*It all depends upon which country you are looking at, and what type of spillover you are attempting to measure" (Graham, 2005:18)*

7.1 Motivation and aims of the thesis

This study sought to investigate the impact of MNC-borne FDI on productivity at the firm level and on economic growth at the aggregate level. The study is motivated by the widely increasing move to attract FDI by putting in place massive incentive packages. Some of these incentives could be misdirected if there is no tangible evidence of spillovers from FDI to productivity both at the micro and macro level.

There are various ways in which this thesis contributes to the literature. Firstly, a thorough literature review unveils the importance of FDI as a conduit for technology transfer. The literature review chapter and the theoretical framework show that on the whole, various paradigms in the FDI theory need to be considered in analysing the relationship between FDI and productivity. Secondly, we are able to identify gaps in the literature and develop a number of hypotheses that help to unveil the relationship between FDI and productivity in a detailed manner. The research questions raised are as follows:

1. Are there any productivity differences between domestic and foreign firms?
2. Does the level of foreign ownership affect productivity differences?
3. Are there any productivity spillovers from foreign to domestic firms?
4. Does FDI have a positive impact on economic growth?
5. Is there a critical level of human capital necessary for FDI to have a positive impact on economic growth?
6. Is there a critical level of financial development necessary for FDI to have a positive effect on economic growth?
7. Is there a critical level of openness necessary for FDI to have a positive effect on economic growth?

8. Are there any different effects between developing, emerging and developed countries for questions 1-8?

The third major contribution is in the empirical section where a large pool of countries is considered, developing, emerging and developed economies, both at the firm level and at the aggregate level. The study explores a wide range of countries and hence complements the existing literature by touching new ground with respect to countries that have not been studied before. The exploration of firm level data from the World Bank Enterprise Survey presents an opportunity for new insights from very recent data. Advancing from the micro level analysis to the macro level, we explore recent time series techniques such as the Toda-Yamamoto analysis, where the causality between FDI and growth is investigated for 37 countries. This is followed by a dynamic panel data analysis wherein the impact of FDI on growth is further investigated using the generalised methods of moments (GMM).

Lastly, based on the informative results from the rigorous analysis carried out in this dissertation, possible policy actions are shaped for governments of developing, emerging and developed economies.

7.2 Findings

In this section, a summary of the results from the empirical chapters is presented. We start with the findings from the firm level analysis that is based on cross sectional data analysis of developing, emerging and developed economies (as presented in Chapter 4). This is followed by the summary of findings from Chapter 5, which focuses on aggregate data and uses the Toda-Yamamoto time series approach which seeks to determine the direction of causality between FDI and economic growth. Finally, we summarise the findings from Chapter 6 which adopts a dynamic panel data approach and uses the generalised method of moments (GMM) technique to investigate the issue of absorptive capacity effects and the contribution of FDI to economic growth at the aggregate level.

7.2.1 Firm level analysis

In Chapter 4, two major issues were investigated, (1) whether there are any productivity differences between domestic and foreign firms and (2) whether there are any spillovers from foreign to domestic firms. The analysis is carried out for countries grouped together according to their levels of development. Three groups are studied, 9 developing, 12 emerging economies and 5 developed countries.

In the case of developing economies, productivity differences are confirmed only where the definition of FDI is below the full ownership level. This cements the idea that some kind of active interaction between domestic and foreign firms is required if any significant differences are to be realised. With the finding that foreign firms are more productive than domestic firms, one anticipates positive spillovers to be evident in developing economies. This expectation is however not met fully as it turns out from the spillover analysis that in the case of developing economies, the spillovers are positive but statistically insignificant. This result could be explained by the fact that our data does not cater for the time factor as the study is essentially a cross sectional analysis. As more surveys are commissioned for the countries in this sample, one would wish to see if a panel specification could change these results. This clearly becomes an issue for further research.

Looking at the emerging economy results, we cannot conclude that foreign firms in these countries are more productive than domestic firms. The coefficients in this case are positive but statistically insignificant. One possible explanation of this outcome is that domestic firms in emerging economies could be highly competitive and hence the data does not reflect any difference between their performance and that of foreign firms (which are likely to be from developed economies). Although the absence of productivity differences sends a signal that no spillovers exist from foreign to domestic firms, we went on to test for this effect. As expected, no positive spillovers are found for this set of countries. The coefficient turns out to be negative and statistically insignificant. While this is statistically insignificant, the result of negative spillovers on its own is puzzling.

One possible explanation is provided by Aitken and Harrison (1999) where negative spillovers arise due to an imperfect competition market structure. This defines another area for further research where one would investigate market structures in each of the emerging countries in the sample and investigate how they affect productivity and the relationship between domestic and foreign firms.

With regards to developed economies, as in the case of emerging economies, there are no statistically significant productivity differences between domestic and foreign firms. It is most plausible in this case that foreign firms investing in developed economies are likely to be firms from other developed economies and hence their productivity compared to that of developed country domestic firms is not expected to be significantly different. In order to complete the picture, the existence of spillovers is investigated for developed economies. It is interesting to note that for these countries, positive and highly significant spillovers are encountered. The size of the spillovers in this case increases with the level of ownership. This puzzle could be explained by the observation by Ramachandran (1993) where foreign investors would devote technology transfer resources to their wholly owned subsidiaries as compared to partially owned subsidiaries. According to Mansfield and Romeo (1980) this would then be a case of vertical spillovers, wherein technology spillovers would increase within the networks of wholly owned subsidiaries. Given this outcome, future research could then be directed to investigating vertical spillovers instead of horizontal spillovers that have been the core of this research.

7.2.2 The Toda Yamamoto Causality Tests

As motivated in Chapter 3, the myriad of findings evident in the literature on FDI and growth calls for an approach that explores different methods of analysis for a similar set of countries. Thus we depart from the micro level analysis to a macro approach. In this case, the sample comprises of 9 developing economies, 12 emerging economies and 16 developed economies. Clearly more countries are investigated in this case than in the firm

level analysis, mainly due to data restrictions in the former as the survey data only covers a limited number of countries.

The results show unidirectional causality from FDI to GDP in Zambia, Colombia and Egypt. These results suggest that in these three countries, we have a case of growth enhancing FDI. There is also evidence of causality which runs from GDP to FDI in China, Indonesia, France, Japan, Spain and the United Kingdom. This is a case where higher levels of economic activity attract foreign direct investment. We also find evidence of bi-directional causality for Kenya, Argentina and Thailand. No clear cut relationship between FDI and growth is established in the rest of the countries; Australia, Austria, Belgium, Brazil, Canada, Chile, Denmark, Finland, Germany, Ghana, Greece, India, Ireland, Italy, Jordan, Madagascar, Malawi, Morocco, South Africa, Sweden, United Kingdom and United states.

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The Toda-Yamamoto framework adopted here results in a mixed bag of results from which one cannot generalize across levels of economic development. These results are very useful where the objective is to study an individual country and derive policy implications for that country. To enable comparison across developing, emerging and developed economies, we consider panel data approaches, the results of which are summarized in Section 7.2.3.

7.2.3 Panel Data Evidence

In Chapter 6, the FDI-Growth relationship for developing, emerging and developed economies is investigated for the period spanning 1975-2006. In order to fully explore this relationship, various specifications and regressions are run in this section. Firstly, all the 37 countries under investigation are grouped together, then in the subsequent analysis separated according to levels of economic development into three main groups: developing, emerging and developed economies.

The results from the panel of 37 countries suggest that an increase in FDI by 1 percent per annum increases GDP by between 0.03 and 0.06 percent per annum. Absorptive capacity effects as measured by openness of the economy, the level of financial development and macroeconomic stability are also investigated in this section. The investigation of the impact of financial development unearthed the possibility of nonlinearities in FDI and the absorptive capacity indicator and thus led to the investigation of threshold effects. The dynamics inherent in an economic growth setting are investigated and the results show that in the short run, there are largely positive effects of FDI on economic growth and in the long run the effects are largely negative.

In view of the heterogeneity of the 37 countries lumped together, we proceed to summarise results that emerge when the countries are split into developing, emerging and develop economies. In the developing economy sample, positive effects between FDI and economic growth are evident. In this case, the importance of the openness of the economy as an absorptive capacity measure in not confirmed. However, nonlinearities that arise when financial development is considered as an absorptive capacity measure suggest that when the level of financial development in developing economies is greater than 23.11 percentage change, FDI becomes negative for economic growth. This result contradicts our expectation that the level of financial development would be beneficial to economic growth. This raises the possibility of international capital flows becoming more harmful to developing economies when extensive development of the domestic financial sector makes it difficult to regulate financial transactions of relatively esoteric financial contracts. This evidence suggests a nuanced embrace of financial globalization for developing economies.

The dynamic panel data results for developing countries show that FDI is positive and statistically significant and that GDP in one year is between 8% and 32% of the difference between the optimal and the current level of per capita GDP (see Table 6.11, in Chapter 6). The marginal effects for developing countries show that when absorptive capacity measures equal the mean, there are positive contributions of FDI to economic

growth. Averaging data over five year periods not only removes cyclical effects but allows for the investigation of human capital as an absorptive capacity effect measure. The results for developing economies confirm the importance of human capital in fostering the spillover benefits of FDI.

The emerging economy results show that openness of the economy is indeed an important measure of absorptive capacity. This result is different from that of developing economies. We also establish that as long as the level of financial development is below 3.52% annual percentage change, the growth effect of FDI would be negative. Hence, in the case of emerging economies, it turns out that a higher level of financial development is critical for economic growth. The dynamic specification shows a largely negative and statistically insignificant impact of FDI on economic growth. The marginal effects for this group of countries show that FDI registers negative effects at the lowest levels of openness, financial development and macroeconomic stability. In the case of developed economies, negative effects of FDI are encountered at the minimum and mean levels of openness. This suggests that for developed economies, a level of openness above the mean value would be ideal for economic growth to be realized through FDI. When considering five year averaged data for emerging economies, it turns out that FDI is statistically insignificant and the absorptive capacity measures lose their significance. This change of results could be explained by the loss of data as a result of averaging. An overall comparison of results from annual data and five year averaged data confirms the robustness of our findings of the relationship between FDI, absorptive capacity measures and economic growth.

7.2.4 Synthesis of the empirical evidence

On the whole, these results to a large extent paint a picture of the absence of growth enhancing FDI, especially for developed economies where there is more evidence of no relationship between the two. This is where it becomes critical that the differences between analytical techniques should be clear before one uses certain findings to draw

policy implications. If one were to look at a micro level analysis as presented in Chapter 4, the conclusion would be that there is great productivity spillovers from MNCs in developed economies and hence advocate for more investment incentives. Yet an analysis based on aggregate data provides different results. We conclude that an individual country approach would be the best to be adopted as a one size fits all policy approach would not be reliable for a group of heterogeneous countries. Corroborating our findings with the work of other scholars, we conclude that our results are complementary. It appears that the contradictions inherent in the FDI-Growth literature could be partly due to methodological differences.

7.3 Policy implications

This study informs public policy and other interested stakeholders in the different countries represented. The importance of policies adopted with the objective of attracting FDI cannot be overemphasized (Addison & Heshmati, 2003). The policy spectrum ranges from general economic policies that aim at strengthening macroeconomic fundamentals; national FDI policies that target the reduction of transaction costs of investors and international FDI policies that deal with bilateral, regional and multilateral agreements. While this thesis has focused mainly on national policies, based on the findings from this research we are able to deduce clear and strong policy implications. The proliferation of policies that seek to attract FDI is not justified in this case. In cases where FDI is not found to be influencing growth, questions are raised about the validity of policies that are formulated on the premise of FDI influencing economic growth. The absorptive capacity variables turn out to be highly significant. Thus policies that seek to develop human capital through education and training are important.

One important implication from the firm level analysis is the possibility that MNCs could have negative influences dominating the positive effects. In this case policy makers are urged to insulate the country from such negative influences. We also recommend suitable changes on existing policies. Policies that enhance promote and support innovative production and economic performances are important. Our results also suggest that

spillover incentive schemes in developing and emerging economies are likely to be misdirected. Linkages between foreign affiliates and domestic firms need to be encouraged if spillover benefits are to be experienced. Where interaction between foreign and domestic firms is encouraged, then skills diffusion, technology diffusion and knowledge diffusion is a possibility. MNCs and domestic firms could, for instance, provide training jointly. Another approach is to attract internationally mobile skills to complement the local skills base.

The inclusion of a number of explanatory variables in the numerous regressions allows us to analyse different policy dimensions. Policies that attract export oriented FDI are important as a key determinant of FDI spillovers. When developing these policies, countries need to attract investments that helps meet the country's needs. There is need for coordinated effort with the government. The targeted effort must be in tune with the overall development strategy of the country.

Another major implication drawn is based on the finding that developing, emerging and developed countries view FDI differently and as history records a movement from radical to free market and national pragmatic views; we note that the current order in most of the countries studied is that of a more liberal approach. In view of this, we suggest that based on this study, policies be adjusted depending on the impact of FDI revealed in this study.

The ultimate lesson drawn from this study is that foreign investment policies must be an integral part of individual countries' development policies. As such, they need to be interrelated to tax policies, antitrust policies, industrial policy, trade policy and education policy. There are a number of issues that policy makers need to be aware of with regards to investment incentives: 1) Investment (FDI) incentives may result in the loss of public revenue, particularly in the case where the investment incentive is greater than the actual positive spillover or externality. 2) Discrimination against domestic firms results in market share losses and ultimately loss of jobs. 3) Incentives also lay the ground for rent seekers due to the nature of selectivity and its influence on corruption (Bhagwati, 2001, Kokko, et al., 2001). 4) Tax holidays and tax breaks may lead to transfer pricing and

other distortions as firms attempt to shift activities to sectors with low tax rates or no taxes at all. 5) There are also problems associated with competition to give the most attractive incentives (Oman, 2000). These bidding contests have the effects of shifting profits from the host country to the multinational firm. All these are interesting areas for further research.

There are countries that have been successful in balancing the investment policies with the needs of the host economy. These include: Ireland which has the right fundamentals. The incentives used to attract foreign firms in Ireland include low taxes, good infrastructure, access to the EU market and increasing labour skills. These incentives have also been available to local firms. This could be the reason why Gorg and Strobl (2001) found evidence of positive spillovers in Ireland. Sweden is another exemplary country in terms of the incentive scheme that does not distinguish or discriminate between foreign and domestic investors.

In the policy processes, consultation is important where the importance of public private partnerships needs to be considered. The type of FDI that a country attracts could have an influence on the type of spillovers that the country gets. It is therefore important that whilst a country focuses on FDI incentives, they ensure that the fundamental determinants of FDI are in place.

7.4 Implications for Further Research

While our study has succeeded in addressing several issues pertaining to FDI and economic growth, we accept that it is not entirely perfect in answering such important questions. As such, it is important that further areas of study are highlighted for future research.

The main issue with incentive schemes is that whilst FDI may fail to contribute positively to economic growth, the incentive schemes in themselves can result in negative welfare implications. While investment incentives are designed to attract foreign firms, at the

local level, subsidies that help domestic firms to improve their absorptive capacities are just as important if not necessary. Most of these subsidies are awarded to the flow of investment funds. One way to improve on this is to have a performance based incentive scheme that would also cater for the stocks of investment and not only focus on the flows. This approach would provide an alternative effective post-audit of FDI incentive schemes.

It would be good to estimate the spillovers and be able to compare them to the size of the incentive given. As more micro data at the firm level is collected, panel techniques can be applied for a similar analysis for country specific research. It would also be better to use longitudinal data from surveys that track the performance of individuals over time. A key issue emerging from this study is that of welfare losses caused by incentives and tax holidays. It would be interesting to do an economy wide analysis of these impacts using computable general equilibrium models. The World Bank Enterprise Survey (WBES) is on an ongoing process of data collection, with the objective of obtaining panel data sets for most of the countries of interest. As such, it would be interesting to re-examine the spillover effects using panel data once it is available. Another research angle would be to focus on the various forms of MNCs (mergers, acquisitions or greenfield investments) and consider how the results are affected once we allow for the entry mode adopted.

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APPENDIX

Table A. 1: Synopsis of Incentives in Selected Countries

Country	Tax holiday/Tax Exemption	Reduced Tax rate	Investment allowance/ Tax credit	Duty/VAT exemption/reduction	R&D allowance	Deduction for qualified expenses
Ghana	*	*		*		
Namibia	*		*	*		*
Zambia	*		*	*		*
Brazil	*	*	*	*		
Chile	*	*	*	*		
China	*	*	*	*	*	
Colombia	*	*	*	*		
Egypt	*			*		
India	*	*	*		*	*
Indonesia	*			*		
Jordan						
Morocco	*	*	*	*		
South Africa	*		*			
Thailand	*			*	*	*
Australia		*	*	*	*	*
Hungary	*		*	*		
Ireland	*	*	*			

Source: UNCTAD (2000)

Table A. 2: Developing Economy Industrial Classification by Sector

Industry	*Botswana*	*Burkina Faso*	*Burundi*	*Kenya*	*Lesotho*	*Madagascar*	Malawi
	I. Manufacturing sector						
1. Textiles	2	-	-	22	29	30	12
2. Leather	-	-	-	5	6	7	
3. Garments	25	4	24	89		52	3
5. Food	12	-	19	14	17	44	55
6. Beverages	-	-	-	-	2	1	
7. Metals and machinery	11	8	6	49	3	20	20
8. Electronics	-	1	-	-	-	-	1
9. Chemicals and pharmaceutics	7	1	11	25	1	17	18
11. Wood and Furniture	16	7	21	20	2	64	24
12. Non metallic & plastic minerals	4	2	1	23	9	13	19
13. Paper	-	12	-	18	1	6	3
14. Sport goods	-	-	-	-	-	-	
16. Other manufacturing	37	-	20	-	5	38	2
26. Auto and auto components	-	130	-	-	-	-	-
Sub-total	**114**	**35**	**102**	**265**	**75**	**292**	**157**
	II. Services sector						
15. IT services	6	-	13	-	-	-	-
17. Telecommunications	-	-	-	-	-	-	-
18. Accounting and finance	-	-	-	-	-	-	-
19. Advertising and marketing	-	-	-	-	-	-	-
20. Other services	112	88	-	-	-	-	-
21. Retail and wholesale trade	-	-	76	-	-	-	-
22. Hotels and restaurants	49	-	30	-	-	-	-
23. Transport	-	-	12	-	-	-	-
24. Real estate and rental services	-	-	-	-	-	-	-
Sub total	**198**	**88**	**132**	**-**	**-**	**-**	**-**
	III. Agro industry						
4. Agro industry	-	14	-	-	-	-	1
Subtotal	**-**	**14**	**-**	**-**	**-**	**-**	**1**
	IV. Construction						
10. Construction	30	1	-	17	-	1-	2
25. Mining and quarrying	-	-	-	-	-	-	-
27. Other transport equipment	-	-	-	-	-	-	-
Subtotal	**30**	**1**	**-**	**17**	**-**	**1**	**2**
	V. Other sector						
99. Other unclassified	-	1	37	-	-	-	-
Subtotal	**-**	**1**	**37**	**-**	**-**	**-**	**-**
GRAND TOTAL	**342**	**139**	**270**	**282**	**75**	**293**	**160**

Source: Author

Table A. 3: Emerging Economy Industrial Classification by Sector

Industry	*Argentina*	*Brazil*	*Chile*	*China*	*Colombia*	*Egypt*	*India*	*Indonesia*	*Jordan*	*Morocco*	South Africa
I. Manufacturing sector											
1. Textiles	117	106	49	-	147	141	225	188	10	160	26
2. Leather	-	173	-	-	-	44	74	-	-	80	11
3. Garments	119	442	72	353	172	120	274	155	88	334	23
5. Food	167	127	160	71	154	156	169	107	93	72	62
6. Beverages	-	-	-	-	-	-		16	-	-	-
7. Metals and machinery	127	185	33	158	-	168	499	2	22	19	131
8. Electronics	1	79	-	524	-	-	255	35	7	30	9
9. Chemicals and pharmaceutics	67	84	74	102	160	65	305	75	36	61	55
11. Wood and Furniture	-	315	-	-	-	58	13	52	-	3	99
12. Non metallic & plastic minerals	3	-	4	-	1	169	158	-	32	77	62
13. Paper	-	-	-	-	-	-	25	28	-	3	17
14. Sport goods	-	-	-	-	-	-		-	-	-	-
16. Other manufacturing	145	-	305	-	15	43	5	-	65	-	89
26. Auto and auto components	-	130	-	401	-	13	216	19	-	-	-
27. Other transport equipment	-	-	-	-	-	-	-	18	-	-	-
Sub-total	**746**	**1641**	**697**	**1609**	**649**	**977**	**2218**	**695**	**353**	**850**	**584**
II. Services Sector											
15. IT services	106	-	119	203	120	-	-	-	8	-	1
17. Telecommunications	-	-	-	7	-	-	-	-	-	-	-
18. Accounting and finance	-	-	-	157	-	-	-	-	-	-	-
19. Advertising and marketing	-	-	-	154	-	-	-	-	-	-	-
20. Other services	64	-	43	270	28	-	1	-	85	-	1
21. Retail and wholesale trade	123	-	123	-	121	-	1948	-	-	-	4
22. Hotels and restaurants	-	-	-	-	-	-	1	-	23	-	1
23. Transport	-	-	-	-	-	-	-	-	-	-	-
24. Real estate and rental services	-	-	-	-	-	-	-	-	-	-	-
Sub total	**293**		**285**	**791**	**269**	**-**	**1950**	**-**	**116**	**-**	**7**
III. Agro industry sector											
4. Agro industry	-	-	-	-	-	-	30	18	-	-	-
Subtotal	**-**	**-**	**-**	**-**	**-**	**-**	**30**	**18**	**-**	**-**	**-**
IV. Construction sector											
10. Construction	24	-	35	-	82	-	1	-	34	-	-
27. Other transport equipment	-	-	-	-	-	-	-	-	-	-	-
Subtotal	**24**		**35**		**82**	**-**	**1**	**-**	**34**	**-**	**-**
V. Other sector											
25. Mining and quarrying	-	-	-	-	-	-	36	-	-	-	4
99. Other unclassified	-	-	-	-	-	-	-	-	-	11	6
Subtotal	**-**	**-**	**-**	**-**	**-**	**-**		**-**	**-**	**11**	**6**
GRAND TOTAL	**1063**	**1641**	**1017**	**2400**	**1000**	**977**	**36**	**713**	**503**	**850**	**597**

Source: Author

Table A. 4: Industrial Classification by Sector in Developed Economies

Industry	*Germany*	*Greece*	*Hungary*	*Ireland*	Spain
		I. Manufacturing sector			
1. Textiles	17	5	5	2	5
2. Leather	1	-	2	-	-
3. Garments	2	7	56	2	1
5. Food	15	8	51	4	3
6. Beverages	41	19	9	15	15
7. Metals and machinery	63	25	212	57	46
8. Electronics	-	-	-	4	2
9. Chemicals and pharmaceutics	5	3	1	12	16
11. Wood and Furniture	25	10	4	26	19
12. Non metallic & plastic minerals	18	6	10	11	8
13. Paper	23	8	9	35	17
14. Sport goods	-	-	-	-	-
16. Other manufacturing	11	7	-	7	2
26. Auto and auto components	-	-	-	-	-
27. Other transport equipment	-	-	-	-	-
Sub-total	**221**	**98**	**359**	**175**	**134**
		II. Services sector			
15. IT services	26	4	5	21	5
17. Telecommunications	16	13	-	6	9
18. Accounting and finance	-	-	-	-	-
19. Advertising and marketing	97	38	17	29	28
20. Other services	76	18	21	25	11
21. Retail and wholesale trade	267	178	98	97	156
22. Hotels and restaurants	66	89	24	40	67
23. Transport	57	30	22	35	46
24. Real estate and rental services	121	12	15	22	45
Sub total	**726**	**382**	**202**	**275**	**367**
		III. Agro industry sector			
4. Agro industry	-	-	-	-	-
Subtotal	**-**	**-**	**-**	**-**	**-**
		IV. Construction sector			
10. Construction	239	61	44	45	102
Subtotal	**239**	**61**	**44**	**45**	**102**
		V. Other sector			
25. Mining and quarrying	10	5	5	6	3
99. Other unclassified	-	-	-	-	-
Subtotal	**25**	**5**	**5**	**6**	**3**
GRAND TOTAL	**1196**	**546**	**610**	**501**	**606**

Source: Author

Table A. 5: Developing Countries Correlation Matrix

	lnK	*lnL*	*AGE*	*OWN*	*TECLICE*	*PROCIN*	*LNRAND*	*EMAIL*	*EXPORT*	*JVENT*	*EDUC*	*TRAIN*	*FINAC*	*SPILPUT*	*SPILEMP*	**SPILEXP1**
lnK	1															
lnL	0.49*	1														
Age	0.15*	0.29*	1													
Own	0.189*	0.257	-0.017	1												
TECLICE	0.064	0.194*	-0.020	0.185*	1											
PROCIN	0.050	0.210*	-0.047	0.184*	0.202*	1										
LnRAND	0.531*	0.276*	-0.043	0.318*	0.037	0.275*	1									
EMAIL	0.237*	0.403*	0.179*	0.148*	0.177*	0.185*	0.022	1								
EXPORT	0.249*	0.354*	-0.22*	0.267*	0.092	0.073	0.271*	-0.100*	1							
JVENT	0.103	0.106	0.034	0.127	0.042	0.029	-0.150	0.114	-0.125	1						
Eductopman	0.193*	0.190*	0.003	0.183	0.074	0.019	0.174*	0.140	0.106	0.098	1					
Train	0.184	0.357*	0.132*	0.147*	0.168*	0.135	0.187*	0.272	0.052	0.181*	0.219*	1				
FINACCSS	0.205*	0.138*	-0.08*	0.073*	0.020	0.046	0.396*	0.007	0.120*	0.057	0.126*	0.071	1			
SPILPUT1	0.294*	0.084*	-0.06*	0.262*	0.078*	0.035	0.224*	-0.006	0.303*	0.033	0.088*	0.166*	0.044	1		
SPILEMP1	0.251*	0.092*	-0.11*	0.301*	0.112*	0.068	0.284*	-0.005	0.410*	-0.087	0.091*	0.126*	0.073*	0.951*	1	
SPILEXP1	0.222*	-0.06*	-0.14*	0.248*	0.108*	0.035	0.313*	-0.073*	0.368*	-0.14*	0.101*	0.110*	0.114*	0.898*	0.945	1

Table A. 6: Emerging Economies Correlation Matrix

	lnK	*lnL*	*AGE*	*OWN*	*TECLICE*	*PROCIN*	*LNRAND*	*EMAIL*	*EXPORT*	*JVENT*	*EDUCt*	*TRAIN*	*FINACCESS*	*SPILPUT1*	*SPILEMP1*	*SPILEXP1*
lnK	1															
lnL	0.575*	1														
Age	0.177*	0.223*	1													
Own	0.204*	0.265*	0.007	1												
TECLICE	0.198*	0.277*	0.079*	0.279*	1											
PROCIN	0.080*	0.149*	0.058*	0.065*	0.138*	1										
LnRAND	0.546*	0.539*	0.048	0.181*	0.162*	0.111*	1									
EMAIL	0.136*	0.319*	0.098*	0.135*	0.138*	0.343*	0.139*	1								
EXPORT	0.012	0.091*	-0.16*	0.075*	-0.024	-0.14*	-0.09*	-0.08*	1							
JVENT	0.061*	0.148*	-0.03*	0.073*	0.127*	-0.099*	0.127*	0.118*	-0.01*	1						
Eductopman	0.194*	0.259*	-0.003	0.142*	0.174*	0.128*	0.119*	0.259*	-0.11*	0.087*	1					
Train	0.164*	0.329*	0.051*	0.125*	0.183*	0.234*	0.270*	0.342*	-0.23*	0.068*	0.234*	1				
FINACCES	-0.04*	-0.11*	-0.019	0.043*	0.054*	-0.06*	-0.14*	-0.17*	0.122*	-0.08*	-0.05*	-0.16*	1			
SPILPUT1	0.167*	0.268*	0.017*	0.175*	0.121*	0.095*	0.242*	0.173*	-0.07*	0.021	0.084*	0.278*	-0.10*	1		
SPILEMP1	0.123*	0.307*	0.032*	0.233*	0.093*	0.086*	0.203*	0.162*	0.105*	0.010	0.059*	0.210*	-0.04*	0.857*	1	
SPILEXP1	0.092*	0.252*	-0.03*	0.168*	0.105*	0.058*	0.205*	0.165*	0.045*	-0.007	0.086*	0.284*	-0.11*	0.905*	0.859*	1

Table A. 7: Developed Country Correlation Matrix

	lnK	*lnL*	*AGE*	*OWN*	*ISOCERT*	*PROCIN*	*EMAIL*	*EXPORT*	*TRAIN*	*EDUC*	*FINACCESS*	*SPILPUT1*	*SPILEMP1*	*SPILEXP1*
lnK	1													
lnL	0.751*	1												
AGE	0.301*	0.324*	1											
OWN	0.212*	0.281*	0.052*	1										
ISOCERT	0.224*	0.285*	0.099*	0.088*	1									
PROCIN	0.159*	0.173*	0.091*	0.011	0.116*	1								
EMAIL	0.286*	0.362*	0.091*	0.106*	0.145*	0.103*	1							
EXPORT	0.190*	0.211*	-0.02*	0.302*	0.064	0.052	0.007	1						
TRAIN	0.305*	0.411*	0.187*	0.055*	0.245*	0.147*	0.197*	0.060	1					
EDUC	-0.16*	-0.14*	-0.09*	0.031	0.035	0.037	0.005	-0.32*	0.006	1				
FINACCESS	0.025*	-0.02	0.071*	-0.10*	-0.04*	0.070*	0.012	-0.09*	0.082*	0.015	1			
SPILPUT1	0.220*	0.198*	0.064*	0.126*	0.118*	0.004	0.145*	0.196*	0.143*	-0.25*	-0.193*	1		
SPILEMP1	0.222*	0.210*	0.096*	0.131*	0.088*	0.023	0.138*	0.228*	0.144*	-0.26*	-0.130*	0.960*	1	
SPILEXP1	0.203*	0.194*	0.056*	0.126*	0.076*	-0.01	0.152*	0.221*	0.147*	-0.30*	-0.150*	0.950*	0.960*	1

Table A. 8: Productivity Differences in Developing Countries, Technology

Variable	*I*	*II*	*III*	*IV*	*V*	*VI*	*VII*	*VIII*	*IX*	*X*	*XI*	*XII*
Constant	6.8565***	6.8554***	6.8091***	6.7038***	6.5961***	6.5945***	6.5318***	6.4088***	6.7019***	6.6998***	6.6283***	6.5168***
	(1.1557)	(1.1560)	(1.1552)	(1.1552)	(1.1935)	(1.1938)	(1.1943)	(1.2021)	(1.1659)	(1.1663)	(1.1684)	(1.1755)
Capital	0.1712***	0.1708***	0.1735***	0.1743***	0.1807***	0.1802***	0.1834***	0.1843***	0.1848***	0.1843***	0.1871***	0.1882***
	(0.0270)	(0.0270)	(0.0270)	(0.0272)	(0.0276)	(0.0277)	(0.0277)	(0.0279)	(0.0265)	(0.0265)	(0.0266)	(0.0268)
Labour	-0.1239**	-0.1225**	-0.1218**	-0.0976*	-0.1008*	-0.0993*	-0.0971*	-0.0689	-0.1346**	-0.1330**	-0.1263**	-0.1023*
	(0.0570)	(0.0570)	(0.0569)	(0.0563)	(0.0573)	(0.0572)	(0.0573)	(0.0566)	(0.0545)	(0.0544)	(0.0544)	(0.0539)
Age	0.0015	0.0015	0.0015	0.0011	0.0033	0.0033	0.0033	0.0029	0.0042	0.0042	0.0043	0.0040
	(0.0038)	(0.0038)	(0.0038)	(0.0038)	(0.0038)	(0.0038)	(0.0038)	(0.0039)	s	(0.0036)	(0.0036)	(0.0037)
Own(10%)	0.3401***				0.3761***				0.3850***			
	(0.1187)				(0.1201)				(0.1146)			
Own(20%)		0.3357***				0.3721***				0.3797***		
		(0.1189)				(0.1201)				(0.1147)		
Own(50%)			0.3499***				0.3655***				0.6368***	
			(0.1232)				(0.1247)				(0.1696)	
Own(100%)				0.2192				0.1994				0.1996***
				(0.1342)				(0.1368)				(0.1315)
ISOCERT	0.7687***	0.7678***	0.7523***	0.7847***								
	(0.1786)	(0.1787)	(0.1791)	(0.1797)								
PROCIN					0.1044	0.1023	0.1021	0.1033				
					(0.1127)	(0.1127)	(0.1129)	(0.1139)				
TECLICE									0.6574***	0.6551***	0.6368**	0.6677***
									(0.1689)	(0.1689)	(0.1696)	(0.1705)
Industry Dummy	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Country dummy	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Adjusted R^2	0.8060	0.8063	0.8064	0.8039	0.7920	0.7919	0.7915	0.7884	0.7930	0.7928	0.7918	0.7918
No. of observations	444	444	444	444	458	458	458	458	483	483	483	483

Table A. 9: Productivity Differences in Developing Countries: International Integration

Variable	*I*	*II*	*III*	*IV*	*V*	*VI*	*VII*	*VIII*	*IX*	*X*	*XI*	*XII*
Constant	6.3844***	6.3840***	6.3250***	6.1960***	2.5378***	2.5378***	2.4754***	2.2465***	4.9461***	4.9461***	4.9312***	5.0544***
	(1.1731)	(1.1734)	(1.1746)	(1.1822)	(1.3069)	(1.3069)	(1.3210)	(1.3280)	(1.3148)	(1.3147)	(1.3346)	1.3556
Capital	0.1898***	0.1894***	0.1925***	0.1937**	0.1905***	0.1905***	0.1934***	0.1929	0.3271***	0.3271***	0.3389***	0.3500***
	(0.0268)	(0.0268)	(0.0268)	(0.0270)	(0.0346)	(0.0346)	(0.0349)	(0.0353)	(0.0672)	(0.0672)	(0.0679)	0.0677
Labour	-0.1679***	-0.1663***	-0.1648***	-0.1409	-0.1517**	-0.1517**	-0.1327*	-0.0950	-	-	-	-
	(0.0584)	(0.0584)	(0.0585)	(0.0582)	(0.0734)	(0.0734)	(0.0741)	(0.0733)	0.3681***	0.3681***	0.3433***	0.3034***
									(0.1072)	(0.1072)	(0.1091)	0.1102
Age	0.0051	0.0050	0.0051	0.0048	0.0016	0.0016	0.0016	0.0011	0.0070	0.0070	0.0073	0.0064
	(0.0037)	(0.0037)	(0.0037)	(0.0037)	(0.0043)	(0.0043)	(0.0043)	(0.0045)	(0.0063)	(0.0063)	(0.0064)	0.0065
Own(10%)	0.3759***				0.5080***				0.5818**			
	(0.1158)				(0.1641)				(0.2654)			
Own(20%)		0.3715***				0.5080***				0.5818**		
		(0.1158)				(0.1641)				(0.2654)		
Own(50%)			0.3561***				0.3643**				0.3575	
			(0.1203)				(0.1731)				(0.2971)	
Own(100%)				0.1832				0.0293				-0.0516
				(0.1323)				(0.1878)				0.3370
EXPORTS	0.4166***	0.4153***	0.4281***	0.4477***								
	(0.1521)	(0.1522)	(0.1522)	(0.1531)								
IMPORTS					0.0057***	0.0057***	0.0058***	0.0060***				
					(0.0019)	(0.0019)	(0.0019)	(0.0019)				
JVENTURE									0.9096**	0.9096**	0.9381**	0.9338**
									(0.3793)	(0.3793)	(0.3843)	0.3883
Industry Dummy	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Country dummy	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Adjusted R^2	0.7901	0.7900	0.7894	0.7863	0.7619	0.7619	0.7571	0.7529	0.4590	0.4590	0.4441	0.4375
No. of observations	483	483	483	483	269	269	269	269	133	133	133	133

Table A. 10: Productivity Differences in Developing Countries: Finance & Infrastructure

Variable	*I*	*II*	*III*	*IV*	*V*	*VI*	*VII*	*VIII*	*IX*	*X*	*XI*	*XII*
Constant	6.6688***	6.6688***	6.7721***	6.8507***	6.3287***	6.3287***	6.2372***	6.1273***	6.3118***	6.3118***	6.2159***	6.1018***
	(0.7080)	(0.7080)	(0.7157)	(0.7221)	(1.1328)	(1.1328)	(1.1396)	(1.1453)	(1.1434)	(1.1434)	(1.1510)	1.1566
Capital	0.2202***	0.2202***	0.2218***	0.2222***	0.1934***	0.1934***	0.1946***	0.1947***	0.1960***	0.1960***	0.1973***	0.1972***
	(0.0359)	(0.0359)	(0.0364)	(0.0366)	(0.0270)	(0.0270)	(0.0272)	(0.0273)	(0.0272)	(0.0272)	0.0274	0.0276
Labour	-0.1490**	-0.1490**	-0.1213	-0.0796	-0.0922	-0.0922	-0.0764	-0.0516	-0.1011*	-0.1011*	-0.0843	-0.0574
	(0.0747)	(0.0747)	(0.0752)	(0.0745)	(0.0590)	(0.0590)	(0.0592)	(0.0584)	(0.0590)	(0.0590)	0.0592	0.0584
Age	0.0042	0.0042	0.0041	0.0035	0.0021	0.0021	0.0021	0.0019	0.0028	0.0028	0.0027	0.0024
	(0.0045)	(0.0045)	(0.0046)	(0.0047)	(0.0037)	(0.0037)	(0.0037)	(0.0037)	(0.0037)	(0.0037)	0.0037	0.0037
Own(10%)	0.5674***				0.4072***				0.4140***			
	(0.1760)				(0.1296)				(0.1311)			
Own(20%)		0.5674***				0.4072***				0.4140***		
		(0.1760)				(0.1296)				(0.1311)		
Own(50%)			0.3835**				0.3008**				0.2940**	
			(0.1871)				(0.1362)				0.1374	
Own(100%)				-0.0131				0.1010				0.0639
				(0.2044)				(0.1486)				(0.1496)
ACFIN	-0.0051	-0.0051	-0.0053	-0.0054								
	(0.0041)	(0.0041)	(0.0042)	(0.0042)								
TRANSP					0.2670*	0.2670*	0.2666*	0.2796*				
					(0.1507)	(0.1507)	0.1517)	(0.1528)				
ELECTRIC									0.0615	0.0615	0.0429	0.0369
									(0.1149)	(0.1149)	(0.1155)	(0.1162)
Industry Dummy	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Country dummy	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Adjusted R^2	0.7552	0.7552	0.7490	0.7446	0.7155	0.7155	0.7117	0.7082	0.7187	0.7187	0.7146	0.7112
No. of observations	256	256	256	256	385	385	385	385	386	386	386	386

Table A. 11: Productivity Differences in Developing Countries, ICT & Telecommunication

Variable	*I*	*II*	*III*	*IV*	*V*	*VI*	*VII*	*VII*	*IX*	*X*	*XI*	*XII*
Constant	6.4894***	6.4869***	6.4307***	6.3074***	6.9445***	6.9423***	6.8704***	6.7522***	6.3148***	6.3148***	6.2184***	6.1044***
	(1.1539)	(1.1544)	(1.1554)	(1.1632)	(1.1642)	(1.1646)	(1.1666)	1.1750	(1.1437)	(1.1437)	(1.1511)	(1.1566)
Capital	0.1707***	0.1704***	0.1728***	0.1735***	0.1761***	0.1757***	0.1784***	0.1793***	0.1967***	0.1967***	0.1977***	0.1976***
	(0.0264)	(0.0264)	(0.0264)	(0.0266)	(0.0265)	(0.0265)	(0.0265)	(0.0267)	(0.0273)	(0.0273)	(0.0275)	(0.0277)
Labour	-0.1708***	-0.1687***	-0.1649***	-0.1400**	-0.1385**	-0.1369**	-0.1307**	-0.1038*	-0.1036*	-0.1036*	-0.0856	-0.0586
	(0.0549)	(0.0549)	(0.0548)	(0.0544)	(0.0542)	(0.0542)	(0.0541)	(0.0536)	(0.0598)	(0.0598)	(0.0600)	(0.0590)
Age	0.0032	0.0031	0.0032	0.0029	0.0025	0.0025	0.0026	0.0021	0.0028	0.0028	0.0027	0.0024
	(0.0036)	(0.0036)	(0.0036)	(0.0036)	(0.0036)	(0.0036)	(0.0036)	(0.0037)	(0.0037)	(0.0037)	(0.0037)	(0.0038)
Own(10%)	0.3780***				0.3952***				0.4114***			
	(0.1135)				(0.1141)				(0.1310)			
Own(20%)		0.3703***				0.3902***				0.4114***		
		(0.1136)				(0.1141)				(0.1310)		
Own(50%)			0.3602***				0.3660***				0.2928**	
			(0.1183)				(0.1190)				(0.1374)	
Own(100%)				0.1960				0.1876				0.0633
				(0.1302)				(0.1311)				(0.1499)
EMAIL	0.5474***	0.5445***	0.5466***	0.5593***								
	(0.1148)	(0.1149)	(0.1151)	(0.1159)								
WEBSITE					0.5478***	0.5464***	0.5364***	0.5456***				
					(0.1278)	(0.1278)	(0.1282)	(0.1292)				
TELECOM									0.0571	0.0571	0.0296	0.0270
									(0.1760)	(0.1760)	(0.1771)	(0.1785)
Industry Dummy	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Country dummy	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Adjusted R^2	0.7959	0.7957	0.7951	0.7920	0.7941	0.7939	0.7930	0.7897	0.7185	0.7185	0.7145	
No. of observations	485	485	485	485	484	484	484	484	386	386	386	386

Table A. 12: Productivity Differences in Developing Countries: Human Capital

Variable	*I*	*II*	*III*	*IV*	*V*	*VI*	*VII*	*VIII*	*IX*	*X*	*XI*	*XII*
Constant	6.4033***	6.4029***	6.3423***	6.2062***	7.5401***	7.5401***	7.4321***	7.3198***	6.8239***	6.8239***	6.9119***	6.9873***
	(1.1546)	1.1550	(1.1559)	(1.1645)	(0.5411)	(0.5411)	(0.5428)	(0.5474)	(0.6979)	(0.6979)	(0.7051)	(0.7111)
Capital	0.1822***	0.1818***	0.1845***	0.1857***	0.2096***	0.2096***	0.2102***	0.2119***	0.2182***	0.2182***	0.2200***	0.2203***
	(0.0263)	0.0263	(0.0264)	(0.0266)	(0.0355)	(0.0355)	(0.0358)	(0.0362)	(0.0359)	(0.0359)	(0.0363)	(0.0366)
Labour	-0.1280***	-0.1263***	-0.1229***	-0.0965*	-0.1472**	-0.1472**	-0.1279*	-0.0912	-0.1682**	-0.1682**	-0.1418**	-0.1026
	(0.0545)	(0.0544)	(0.0544)	(0.0540)	(0.0753)	(0.0753)	(0.0753)	(0.0751)	(0.0745)	(0.0745)	(0.0749)	(0.0742)
Age	0.0028	0.0028	0.0030	0.0026	0.0021	0.0021	0.0022	0.0018	0.0029	0.0029	0.0029	0.0023
	(0.0036)	(0.0036)	(0.0036)	(0.0036)	(0.0047)	(0.0047)	(0.0047)	(0.0048)	(0.0045)	(0.0045)	(0.0046)	(0.0046)
Own(10%)	0.4012***				0.5519***				0.5594***			
	(0.1142)				(0.1749)				(0.1754)			
Own(20%)		0.3962***				0.5519***				0.5594***		
		(0.1142)				(0.1749)				(0.1754)		
Own(50%)			0.3896***				0.4486**				0.3881**	
			(0.1191)				(0.1823)				(0.1864)	
Own(100%)				0.2284*				0.0946				0.0088
				(0.1317)				(0.1996)				(0.2033)
TRAIN	□52□□5**	0.3268***	0.3316***	0.3457***								
	*0.1079)	(0.1080)	(0.1081)	(0.1090)								
EDUC					0.3479	0.3479	0.3958*	0.4344*				
					(0.2114)	(0.2114)	(0.2118)	(0.2139)				
BUSASOC									0.0746	0.0746	0.0793	0.0964
									(0.1637)	(0.1637)	(0.1656)	(0.1672)
Industry Dummy	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Country dummy	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Adjusted R^2	0.7956	0.7955	0.7949	0.7915	0.7289	0.7289	0.7246	0.7179	0.7506	0.7506	0.7447	0.7402
No. of observations	482	482	482	482	252	252	252	252	258	258	258	258

Table A. 13: Productivity Differences in Emerging Economies: Technology

Variable	*I*	*II*	*III*	*IV*	*V*	*VI*	*VII*	*VIII*	*IX*	*X*	*XI*	*XII*
Constant	2.5711**	2.5664**	2.5556**	2.5257**	2.4590**	2.4518**	2.4423***	2.4020***	3.9947	4.0079***	4.0090***	4.0046***
	(1.1920)	(1.1918)	(1.1924)	(1.1913)	(1.1817)	(1.1814)	1.1819	1.1818	0.2926	0.2905	0.2911	0.2878
Capital	0.2788***	0.2788***	0.2792***	0.2808***	0.2765***	0.2765***	0.2766***	0.2799***	0.1545	0.1511***	0.1533***	0.1500***
	(0.0156)	(0.0156)	(0.0156)	(0.0155)	(0.0153)	(0.0153)	0.0153	0.0152	0.0429	0.0426	0.0425	0.0422
Labour	-0.1702***	-0.1702***	-0.1670***	-0.1675***	-0.1262***	-	-	-0.1226	-0.2279	-	-	-
	(0.0265)	(0.0264)	(0.0264)	(0.0263)	(0.0255)	0.1260***	0.1228***	0.0253	0.0639	0.2279***	0.2295***	0.2267***
						(0.0254)	0.0254			0.0637	0.0638	0.0634
Age	-0.0022	-0.0221	-0.0022	-0.0022	-0.0022**	-0.0022**	-0.0023**	-	0.0049	0.0050**	0.0049**	0.0048**
	(0.0014)	(0.0014)	(0.0014)	(0.0014)	(0.0014)	(0.0013)	0.0013	0.0024***	0.0024	0.0025	0.0025	0.0025
								0.0013				
Own(10%)	0.2499***				0.3324***				0.1101			
	(0.0910)				(0.0891)				0.1549			
Own(20%)		0.2661***				0.3479***				0.2162		
		(0.0921)				(0.0903)				0.1566		
Own(50%)			0.2549***				0.3655***				0.2173	
			(0.1033)				0.1011				0.1728	
Own(100%)				0.3846***				0.4315***				0.4295**
				(0.1208)				0.1185				0.1938
ISOCERT	0.3199***	0.3198***	0.3191***	0.3139***								
	(0.0739)	(0.0738)	(0.0740)	(0.0739)								
PROCIN					-0.0432	-0.0424	-0.0449	0.4315				
					(0.0611)	(0.0611)	0.0611	0.1185				
RAND									0.1441	0.1424***	0.1437***	0.1406***
									0.0385	0.0384	0.0383	0.0382
Industry Dummy	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Country dummy	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Adjusted R^2	0.8981	0.8981	0.8980	0.8982	0.8994	0.8994	0.8994	0.8994	0.4224	0.4252	0.4245	0.4310
No. of observations	2252	2252	2252	2252	2295	2295	2295	2295	306	306	306	306

Table A. 14: Productivity Differences in Emerging Economies: International Integration

Variable	*I*	*II*	*III*	*IV*	*V*	*VI*	*VII*	*VIII*	*IX*	*X*	*XI*	*XII*
Constant	4.9885***	4.9904***	4.9777***	4.9552***	3.2316**	3.2262	3.2149***	3.1882***	4.0681***	4.0621***	4.0623***	4.0077***
	(1.2187)	(1.2176)	(1.2183)	(1.2127)	(0.4317)	(0.4315)	(0.4316)	(0.4311)	(0.5050)	(0.5050)	(0.5048)	(0.5042)
Capital	0.3526***	0.3520***	0.3522***	0.3540***	0.2834***	0.2835	0.2838***	0.2850***	0.3556***	0.3561***	0.3566***	0.3608***
	(0.0249)	(0.0248)	(0.0249)	(0.0246)	(0.0154)	(0.0154)	(0.0154)	(0.0153)	(0.0219)	(0.0219)	(0.0219)	(0.0218)
Labour	-0.3788***	-0.3788***	-0.3760***	-0.3793***	-0.1521***	-0.1518	-	-	-	-	-	-
	(0.0415)	(0.0414)	(0.0414)	(0.0412)	(0.0256)	(0.0256)	0.1496***	0.1507***	0.2298***	0.2294***	0.2291***	0.2284***
							(0.0255)	(0.0255)	(0.0380)	(0.0380)	(0.0380)	(0.0380)
Age	-0.0018	-0.0018	-0.0019	-0.0017	-0.0023	-0.0023	-0.0023*	-0.0023	-0.0044**	-0.0044**	-0.0044*	-0.0045*
	(0.0021)	(0.0021)	(0.0021)	(0.0021)	(0.0014)	(0.0014)	(0.0014)	(0.0014)	(0.0024)	(0.0024)	(0.0024)	(0.0024)
Own(10%)	0.2655**				0.2316***				0.3358**			
	(0.1087)				(0.0922)				(0.1298)			
Own(20%)		0.3022***				0.2436***				0.3334**		
		(0.1102)				(0.0936)				(0.1314)		
Own(50%)			0.3027**				0.2384**				0.3778***	
			(0.1201)				(0.1044)				(0.1428)	
Own(100%)				0.5175***				0.3715***				0.4290**
				(0.1379)				(0.1217)				(0.1673)
EXPORTS	-0.0447	-0.0453	-0.0437	-0.0493								
	(0.0343)	(0.0342)	(0.0342)	(0.0341)								
TECLICE					0.2388***	0.2353***	0.2412***	0.2397***				
					(0.0767)	(0.0768)	(0.0768)	(0.0759)				
JVENTURE									0.0662	0.0646	0.0643	0.0871
									(0.1965)	(0.1966)	(0.1965)	(0.1965)
Industry Dummy	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Country dummy	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Adjusted R^2	0.8903	0.8905	0.8904	0.8913	0.8980	0.8980	0.8980	0.8981	0.8923	0.8922	0.8923	0.8923
No. of observations	898	898	898	898	2291	2291	2291	2291	1167	1167	1167	1167

Table A. 15: Productivity Differences in Emerging Economies: Finance and Infrastructure

Variable	*I*	*II*	*III*	*IV*	*V*	*VI*	*VII*	*VIII*	*IX*	*X*	*XI*	*XII*
Constant	3.1578***	3.1555***	3.1600***	3.1322***	2.3844***	2.3783***	2.3696***	2.3368***	2.3796***	2.3733***	2.3646***	2.3314***
	(0.2362)	(0.2362)	(0.2363)	(0.2357)	(1.1900)	(1.1897)	(1.1903)	(1.1892)	(1.1882)	(1.1880)	(1.1886)	(1.1874)
Capital	0.3694***	0.3698***	0.3704***	0.3726***	0.2894***	0.2895***	0.2900***	0.2921***	0.2917***	0.2917***	0.2922***	0.2944***
	(0.0219)	(0.0219)	(0.0219)	(0.0218)	(0.0155)	(0.0155)	(0.0155)	(0.0154)	(0.0155)	(0.0155)	(0.0155)	(0.0154)
Labour	-0.2498***	-0.2495***	-0.2492***	-0.2493***	-0.1448***	-	-	-	-	-	-	-
	(0.0377)	(0.0377)	(0.0377)	(0.0375)	(0.0255)	0.1446***	0.1418***	0.1425***	0.1463***	0.1461***	0.1433***	0.1441***
						(0.0255)	(0.0254)	(0.0254)	(0.0255)	(0.0254)	(0.0254)	(0.0253)
Age	-0.0045*	-0.0045*	-0.0046*	-0.0046*	-0.0022	-0.0022	-0.0023*	-0.0023*	-0.0023*	-0.0023*	-0.0023*	-0.0024*
	(0.0024)	(0.0024)	(0.0024)	(0.0024)	(0.0014)	(0.0014)	(0.0014)	(0.0014)	(0.0014)	(0.0014)	(0.0016)	(0.0014)
Own(10%)	0.2787**				0.3059***				0.3083***			
	(0.1302)				(0.0904)				(0.0902)			
Own(20%)		0.2753**				0.3213***				0.3235***		
		(0.1318)				(0.0916)				(0.0915)		
Own(50%)			0.3062**				0.3201***				0.3219***	
			(0.1432)				(0.1019)				(0.1017)	
Own(100%)				0.4442**				0.4513***				0.4572***
				(0.1686)				(0.1200)				(0.1198)
FINACCESS	0.0005	0.0005	0.0005	0.0006								
	(0.0023)	(0.0023)	(0.0023)	(0.0023)								
TRANSP					0.0438	0.0423	0.0440	0.0400				
					(0.0977)	(0.0977)	(0.0978)	(0.0977)				
ELECTRIC									-0.0968	-0.0965	-0.0950	-0.0998
									(0.0674)	(0.0674)	(0.0674)	(0.0674)
Industry Dummy	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Country dummy	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Adjusted R^2	0.8906	0.8906	0.8906	0.8908	0.8978	0.8979	0.8977	0.8979	0.8982	0.8982	0.8981	0.8983
No. of observations	1183	1183	1183	1183	2288	2288	2288	2288	2297	2297	2297	2297

Table A. 16: Productivity Differences in Emerging Economies: ICT and Telecommunication

Variable	*I*	*II*	*III*	*IV*	*V*	*VI*	*VII*	*VII*	*IX*	*X*	*XI*	*XII*
Constant	3.1176***	3.1115***	3.0974***	3.0614***	3.1614***	3.1556***	3.1424***	3.1090***	3.1432***	3.1403***	3.1443***	3.1150***
	(0.4291)	(0.4289)	(0.4290)	(0.4283)	(0.4295)	(0.4294)	(0.4294)	(0.4288)	(0.2324)	(0.2324)	(0.2324)	(0.2320)
Capital	0.2768***	0.2768***	0.2769***	0.2788***	0.2849***	0.2849***	0.2851***	0.2868***	0.3735***	0.3740***	0.3746***	0.3768***
	(0.0153)	(0.0153)	(0.0153)	(0.0152)	(0.0153)	(0.0152)	(0.0153)	(0.0152)	(0.0221)	(0.0220)	(0.0220)	(0.0219)
Labour	-0.1780***	-0.1780***	-0.1753***	-0.1766***	-	-	-	-	-	-	-	-
	(0.0262)	(0.0262)	(0.0261)	(0.0261)	0.1781***	0.1779***	0.1757***	0.1768***	0.2509***	0.2505***	0.2502***	0.0050***
					(0.0263)	(0.0263)	(0.0262)	(0.0262)	(0.0379)	(0.0379)	(0.0378)	(0.0024)
Age	-0.0015	-0.0015	-0.0016	-0.0016	-0.0021	-0.0021	-0.0021	-0.0022	-0.0050**	-0.0050**	-0.0050**	-0.0050**
	(0.0014)	(0.0014)	(0.0014)	(0.0013)	(0.0014)	(0.0013)	(0.0013)	(0.0013)	(0.0024)	(0.0024)	(0.0024)	(0.0024)
Own(10%)	0.2930***				0.2769***				0.2776**			
	(0.0890)				(0.0891)				(0.1301)			
Own(20%)		0.3080***				0.2901***				0.2704**		
		(0.0902)				(0.0903)				(0.1317)		
Own(50%)			0.3168***				0.2999***				0.3015**	
			(0.1007)				(0.1009)				(0.1431)	
Own(100%)				0.4539***				0.4339***				0.4442***
				(0.1185)				(0.1186)				(0.1684)
EMAIL	0.3829***	0.3829***	0.3851***	0.3901***								
	(0.0726)	(0.0726)	(0.0726)	(0.0725)								
WEBSITE					0.3155***	0.3148***	0.3184***	0.3212***				
					(0.0615)	(0.0615)	(0.0615)	(0.0614)				
TELECOM									-0.2202	-0.2131	-0.2128	-0.2203
									(0.1590)	(0.1590)	(0.1590)	(0.1588)
Industry Dummy	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Country dummy	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Adjusted R^2	0.8992	0.8992	0.8991	0.8994	0.8991	0.8992	0.8991	0.8993	0.8908	0.8907	0.8908	0.8910
No. of observations	2311	2311	2311	2311	2304	2304	2304	2304	1173	1173	1173	1173

Table A. 17: Productivity Differences in Emerging Economies: Human Capital

Variable	*I*	*II*	*III*	*IV*	*V*	*VI*	*VII*	*VIII*	*IX*	*X*	*XI*	*XII*
Constant	2.9228***	0.2917***	2.9079***	2.8805***	3.1091***	3.1065***	3.1100***	3.0804***	2.2587*	2.2520*	2.2444*	2.2038*
	(1.1514)	(0.0902)	(1.1518)	(1.1512)	(0.2332)	(0.2332)	(02332)	(0.2327)	(1.2340)	(1.2340)	(1.2338)	(1.2323)
Capital	0.2694***	0.2694***	0.2699***	0.2720***	0.3630***	0.3634***	0.3638***	0.3659***	0.3357***	0.3360***	0.3360***	0.3384***
	(0.0155)	(0.0155)	(0.0156)	(0.0155)	(0.0222)	(0.0222)	(0.0222)	(0.0221)	(0.0192)	(0.0192)	(0.0192)	(0.0191)
Labour	-0.1327	-0.1326	-0.0019***	-0.1298***	-0.2594***	-	-	-	-	-	-	-
	(0.0261)	(0.0261)	(0.0013)	(0.0260)	(0.0380)	0.2590***	0.2591***	0.2592***	0.1835***	0.1828***	0.1810***	0.1812***
						(0.0380)	(0.0380)	(0.0379)	(0.0331)	(0.0331)	(0.0329)	(0.0328)
Age	-0.0019***	-0.0019***	-0.0019***	-0.0020	-0.0043*	-0.0043*	-0.0044*	-0.0043*	-0.0042**	-0.0042**	-0.0042**	-0.0042**
	(0.0013)	(0.0013)	(0.0013)	(0.0013)	(0.0024)	(0.0024)	(0.0024)	(0.0024)	(0.0020)	(0.0020)	(0.0020)	(0.0020)
Own(10%)	0.2766				0.2727**				0.2773**			
	(0.0889)				(0.1300)				(0.1147)			
Own(20%)		0.2917				0.2689**				0.2779**		
		(0.0902)				(0.1316)				(0.1166)		
Own(50%)			0.2831				0.3033**				0.3203**	
			(0.1009)				(0.1429)				(0.1295)	
Own(100%)				0.3811***				0.4422***				0.4871***
				(0.1193)				(0.1682)				(0.1548)
TRAIN	0.1770***	0.1766***	0.1768***	0.1766								
	(0.0608)	(0.0608)	(0.0608)	(0.0608)								
EDUC					0.1636*	0.1636*	0.1669*	0.1682*				
					(0.0944)	(0.0944)	(0.0944)	(0.0943)				
BUSASOC									-0.0001	-0.0001	-0.0001	-0.0001
									(0.0012)	(0.0012)	(0.0012)	(0.0012)
Industry Dummy	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Country dummy	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Adjusted R^2	0.9007	0.9007	0.9006	0.9007	0.8909	0.8909	0.8909	0.8911	0.9054	0.9054	0.9054	0.9057
No. of observations	2176	2176	2176	2176	1183	1183	1183	1183	1522	1522	1522	1522

Table A. 18: Productivity Differences in Developed Economies: Technology

Variable	*I*	*II*	*III*	*IV*	*V*	*VI*	*VII*	*VIII*
Constant	3.0865***	3.0860***	3.0858***	3.0862***	3.0765***	3.0760***	3.0756***	3.0758***
	(0.0836)	(0.0836)	(0.0835)	(0.0835)	(0.0844)	(0.0844)	(0.0844)	(0.0844)
Capital	0.2638***	0.2638***	0.2638***	0.2635***	0.2641***	0.2640***	0.2641***	0.2639***
	(0.0109)	(0.0109)	(0.0109)	(0.0109)	(0.0109)	(0.0109)	(0.0109)	(0.0109)
Labour	-0.1706***	-0.1700***	-0.1701***	-0.1681***	-0.1684***	-	-	-
	(0.0140)	(0.0140)	(0.0139)	(0.0138)	(0.0139)	0.1678***	0.1678***	0.1658***
						(0.0139)	(0.0138)	(0.0137)
Age	0.0007	0.0007	0.0007	0.0006	0.0007	0.0007	0.0007	0.0007
	(0.0008)	(0.0008)	(0.0008)	(0.0008)	(0.0008)	(0.0008)	(0.0008)	(0.0008)
Own(10%)	0.0254				0.0320			
	(0.0490)				(0.0492)			
Own(20%)		0.0162				0.0225		
		(0.0495)				(0.0498)		
Own(50%)			0.0204				0.0276	
			(0.0523)				(0.0526)	
Own(100%)				0.0635				-0.0236
				(0.0421)				0.0639)
ISOCERT	0.0625	0.0626	0.0626	0.0635				
	(0.0421)	(0.0495)	(0.0421)	(0.0421)				
PROCIN					0.0050	0.0049	0.0049	0.0040
					(0.0333)	(0.0333)	(0.0333)	(0.0333)
Industry Dummy	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Country dummy	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Adjusted R^2	0.3072	0.3072	0.3072	0.3072	0.3071	0.3070	0.3070	0.3070
No. of observations	2576	2576	2576	2576	2565	2565	2565	2565

Table A. 19: Productivity Differences in Developed Economies: International Integration

Variable	*I*	*II*	*III*	*IV*	*V*	*VI*	*VII*	*VIII*
Constant	3.5472***	3.5450***	3.5438***	3.5355***	3.0823***	3.0818***	3.0816***	3.0820***
	(0.2805)	(0.2806)	(0.2803)	(0.2803)	(0.0835)	(0.0835)	(0.0835)	(0.0835)
Capital	0.2862***	0.2863***	0.2864***	0.2880***	0.2639***	0.2638***	0.2639***	0.2636
	(0.0212)	(0.0212)	(0.0212)	(0.0212)	(0.0109)	(0.0109)	(0.0109)	(0.0109)
Labour	-0.2119***	-0.2113***	-0.2116***	-0.2093***	-	-	-	-0.1669
	(0.0267)	(0.0267)	(0.0266)	(0.0265)	0.1692***	0.1686***	0.1688***	(0.0137)
					(0.0138)	(0.0138)	(0.0138)	
Age	-0.0006	-0.0006	-0.0006	-0.0005	0.0007	0.0007	0.0007	0.0006
	(0.0014)	(0.0014)	(0.0014)	(0.0014)	(0.0008)	(0.0008)	(0.0008)	(0.0008)
Own(10%)	0.1051				0.0228			
	(0.0719)				(0.0490)			
Own(20%)		0.0985				0.0129		
		(0.0724)				(0.0495)		
Own(50%)			0.1196				0.0184	
			(0.0758)				(0.0523)	
Own(100%)				0.1228				-0.0348
				(0.0896)				(0.0635)
EXPORTS	-0.1089***	-0.1083***	-0.1091***	-0.1063***				
	(0.0260)	(0.0261)	(0.0260)	(0.0257)				
IMPORTS					0.1264*	0.1267*	0.1268*	0.1279
					(0.0660)	(0.0660)	(0.0660)	(0.0659)
Industry Dummy	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Country dummy	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Adjusted R^2	0.3779	0.3776	0.3782	0.3776	0.3076	0.3076	0.3076	
No. of observations	666	666	666	666	2576	2576	2576	2576

Table A. 20: Productivity Differences in Developed Economies: Finance & Infrastructure

Variable	*I*	*II*	*III*	*IV*	*V*	*VI*	*VII*	*VIII*	*IX*	*X*	*XI*	*XII*
Constant	3.0828***	3.0823***	3.0820***	3.0821***	3.0880***	3.0875***	3.0873***	3.0875***	3.0864***	3.0859***	3.0856***	3.0860***
	(0.0837)	(0.0837)	(0.0837)	(0.0837)	(0.0840)	(0.0840)	(0.0840)	(0.0840)	(0.0837)	(0.0837)	(0.0837)	(0.0837)
Capital	0.2610***	0.2610***	0.2610***	0.2608***	0.2644***	0.2643***	0.2644***	0.2641***	0.2649***	0.2649***	0.2649***	0.2647***
	(0.0109)	(0.0109)	(0.0524)	(0.0109)	(0.0109)	(0.0109)	(0.0109)	(0.0109)	(0.0109)	(0.0109)	(0.0109)	(0.0109)
Labour	-0.1640***	-0.1634***	-0.1634***	-0.1615***	-0.1675***	-	-	-	-	-	-	-
	(0.0138)	(0.0138)	(0.0138)	(0.0137)	(0.0139)	0.1669***	0.1670***	0.1651***	0.1685***	0.1679***	0.1680***	0.1661***
						(0.0138)	(0.0138)	(0.0137)	(0.0139)	(0.0138)	(0.0138)	(0.0137)
Age	0.0009	0.0009	0.0009	0.0009	0.0007	0.0007	0.0007	0.0006	0.0007	0.0007	0.0007	0.0007
	(0.0008)	(0.0008)	(0.0008)	(0.0008)	(0.0008)	(0.0008)	(0.0008)	(0.0008)	(0.0008)	(0.0008)	(0.0008)	(0.0008)
Own(10%)	0.0316				0.0264				0.0250			
	(0.0491)				(0.0491)				(0.0491)			
Own(20%)		0.0220				0.0169				0.0151		
		(0.0496)				(0.0496)				(0.0496)		
Own(50%)			0.0266				0.0216				0.0194	
			(0.0524)				(0.0524)				(0.0524)	
Own(100%)				-0.0243				-0.0320				-0.0325
				(0.0637)				(0.0637)				(0.0636)
ACFIN	0.0020**	0.0020**	0.0020**	0.0019**								
	(0.0009)	(0.0009)	(0.0009)	(0.0009)								
TRANSP					0.0266	0.0267	0.0270	0.0267				
					(0.0605)	(0.0607)	(0.0605)	(0.0605)				
ELECTRIC									-0.1027	-01030	-0.1028	-0.1043
									(0.0705)	(0.0706)	(0.0706)	(0.0705)
Industry Dummy	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Country dummy	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Adjusted R^2	0.3059	0.3059	0.3059	0.3059	0.3058	0.3058	0.3058	0.3058	0.3064	0.3064	0.3064	0.3064
No. of observations	2563	2563	2563	2563	2562	2562	2562	2562	2566	2566	2566	2566

Table A. 21: Productivity Differences in Developed Countries: ICT & Telecommunication

Variable	*I*	*II*	*III*	*IV*	*V*	*VI*	*VII*	*VIII*
Constant	3.0421***	3.0416***	3.0415***	3.0417***	3.0402***	3.0397***	3.0395***	3.0398***
	(0.0834)	(0.0834)	(0.0833)	(0.0833)	(0.0835)	(0.0835)	(0.0835)	(0.0835)
Capital	0.2610***	0.2609***	0.2609***	0.2607***	0.2610***	0.2610***	0.2610***	0.2608***
	(0.0108)	(0.0108)	(0.0108)	(0.0108)	(0.0109)	(0.0109)	(0.0109)	(0.0109)
Labour	-0.1820***	-0.1814***	-0.1816***	-0.1798***	-	-	-	-
	(0.0140)	(0.0139)	(0.0139)	(0.0138)	0.1809***	0.1803***	0.1805***	0.1786***
					(0.0140)	(0.0139)	(0.0139)	(0.0138)
Age	0.0007	0.0007	0.0007	0.0007	0.0008	0.0008	0.0008	0.0008
	(0.0008)	(0.0008)	(0.0008)	(0.0008)	(0.0008)	(0.0008)	(0.0008)	(0.0008)
Own(10%)	0.0236				0.0243			
	(0.0487)				(0.0488)			
Own(20%)		0.0143				0.0143		
		(0.0492)				(0.0493)		
Own(50%)			0.0210				0.0195	
			(0.0520)				(0.0521)	
Own(100%)				-0.0281				-0.0318
				(0.0632)				(0.0632)
EMAIL	0.2248***	0.2249***	0.2250***	0.2247***				
	(0.0392)	(0.0392)	(0.0392)	(0.0392)				
WEBSITE					0.1959***	0.1959***	0.1959***	0.1959***
					(0.0371)	(0.0371)	(0.0521)	(0.0371)
Industry Dummy	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Country dummy	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Adjusted R^2	0.3154	0.3154	0.3154	0.3154	0.3141	0.3140	0.3140	0.3141
No. of observations	2576	2576	2576	2576	2576	2576	2576	2576

Table A. 22: Productivity Differences in Developed Countries: Human Capital

Variable	*I*	*II*	*III*	*IV*	*V*	*VI*	*VII*	*VIII*	*IX*	*X*	*XI*	*XII*
Constant	3.0888***	3.0877***	3.0866***	3.0889***	3.1098***	3.1089***	3.1077***	3.1145***	3.0458***	3.0452***	3.0451***	3.0450***
	(0.1136)	(0.1136)	(0.1136)	(0.1138)	(0.1097)	(0.1097)	(0.1096)	(0.1097)	(0.0860)	(0.0860)	(0.0860)	(0.0860)
Capital	0.2533***	0.2530***	0.2529***	0.2528***	0.2352***	0.2350***	0.2347***	0.2335***	0.2636***	0.2636***	0.2636***	0.2633***
	(0.0173)	(0.0173)	(0.0173)	(0.0173)	(0.0154)	(0.0154)	(0.0158)	(0.0154)	(0.0109)	(0.0109)	(0.0109)	(0.0109)
Labour	-0.1553***	-0.1540***	-0.1531***	-0.1537***	-0.1386***	-	-	-	-	-	-	-
	(0.0225)	(0.0224)	(0.0222)	(0.0220)	(0.0199)	0.1376***	0.1365***	0.1366***	0.1701***	0.1695***	0.1696***	0.1677***
						(0.0198)	(0.0197)	(0.0196)	(0.0139)	(0.0139)	(0.0138)	(0.0137)
Age	0.0040***	0.0040***	0.0040	0.0040	0.0037	0.0037	0.0037	0.0036	0.0006	-0.0006	0.0006	0.0005
	(0.0014)	(0.0014)	(0.0014)	(0.0014)	(0.0080)	(0.0013)	(0.0013)	(0.0013)	(0.0008)	(0.0008)	(0.0008)	(0.0008)
Own(10%)	0.0243				0.0080				0.0244			
	(0.0774)				(0.0691)				(0.0490)			
Own(20%)		0.0038				-0.0102				0.0153		
		(0.0783)				(0.0699)				(0.0495)		
Own(50%)			0.0191				-0.0411				0.0190	
			(0.0798)				(0.0715)				(0.0523)	
Own(100%)				-0.0230				-0.1032				-0.0364
				(0.1197)				(0.0997)				(0.0636)
TRAIN	0.0538	0.0535	0.0532	0.0535								
	(0.0534)	(0.0534)	(0.0534)	(0.0534)								
EDUC					0.0018*	0.0012*	0.0012*	0.0012*				
					(0.0007)	(0.0007)	(0.0007)	(0.0007)				
BUSASOC									0.0647*	0.0649*	0.0647*	0.0656*
									(0.0350)	(0.0350)	(0.0350)	(0.0350)
Industry Dummy	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Country dummy	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Adjusted R^2	0.2732	0.2731	0.2732	0.2732	0.2366	0.2366	0.2368	0.2373	0.3075	0.3075	0.3075	0.3076
No. of observations	924	924	924	924	1212	1212	1212	1212	2576	2576	2576	2576